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(54) **DATA DELIVERY SYSTEM, DATA RECEIVING APPARATUS, AND STORAGE MEDIUM FOR VIDEO PROGRAMS**

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(51) Int. Cl.⁷ **H04N 7/173**

(52) U.S. Cl. **725/101; 386/125; 725/91; 725/100**

(58) Field of Search 725/91, 100, 101; 386/111, 125; 348/432.1; 455/4.2, 5.1; **H04N 7/173**

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(57) **ABSTRACT**

In an NVOD system, a data storage unit is provided in a receiving apparatus, whereby a video program can be provided with an instantaneous response equivalent to the VOD system. Namely, the data of the first part of the video data is stored in the data storage unit in advance. When there is a request for reproduction, that stored data is immediately reproduced. The data after the first data is sent from a transmitting apparatus in the same way as an NVOD system heretofore. Buffering is performed in the receiving apparatus, and the resultant data is reproduced continuous with the data of the first part.

3 Claims, 7 Drawing Sheets

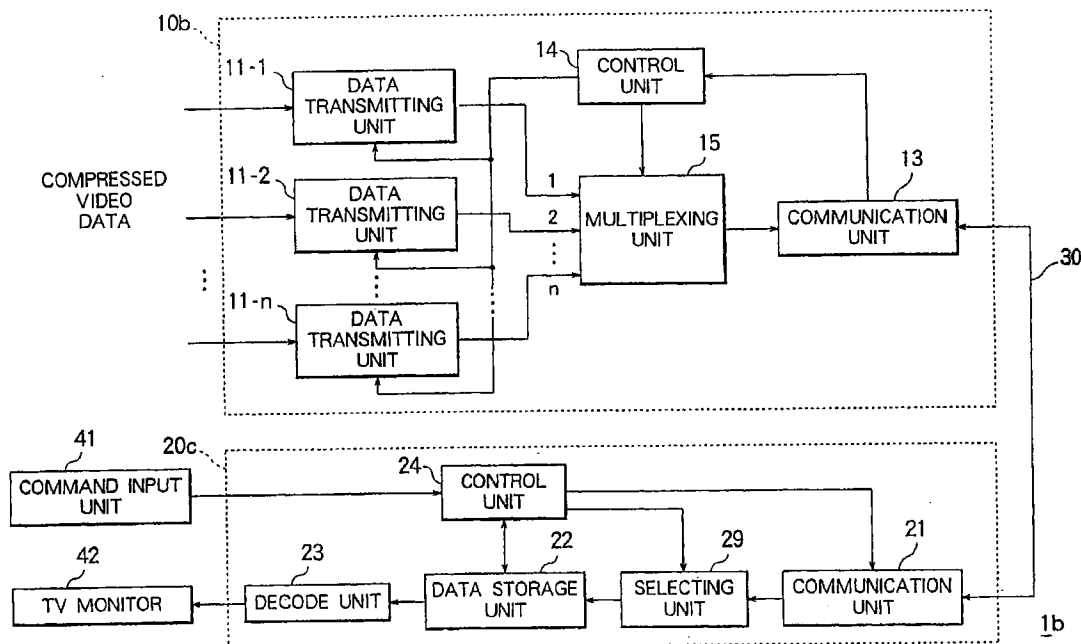


FIG. 1

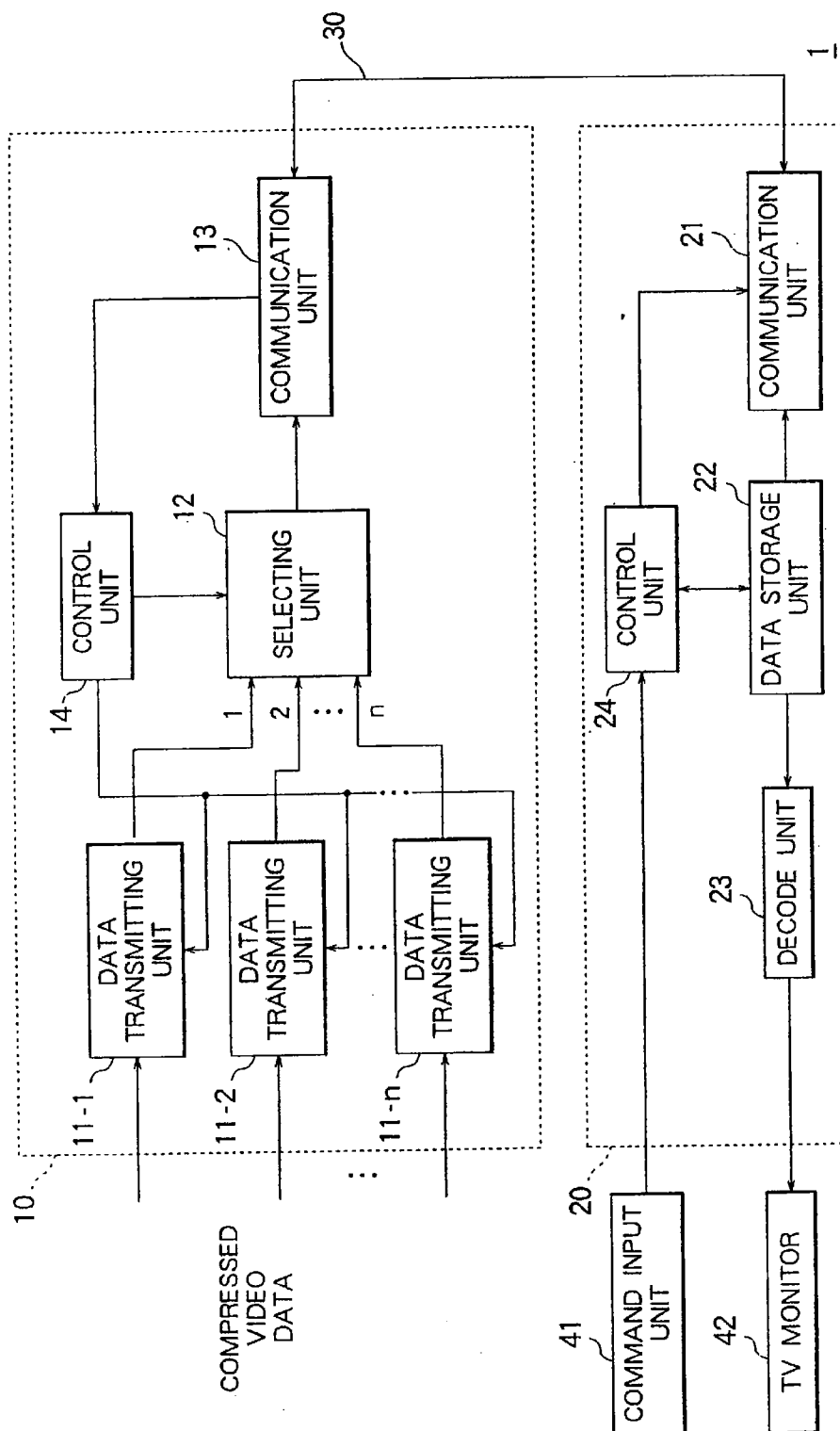


FIG. 2

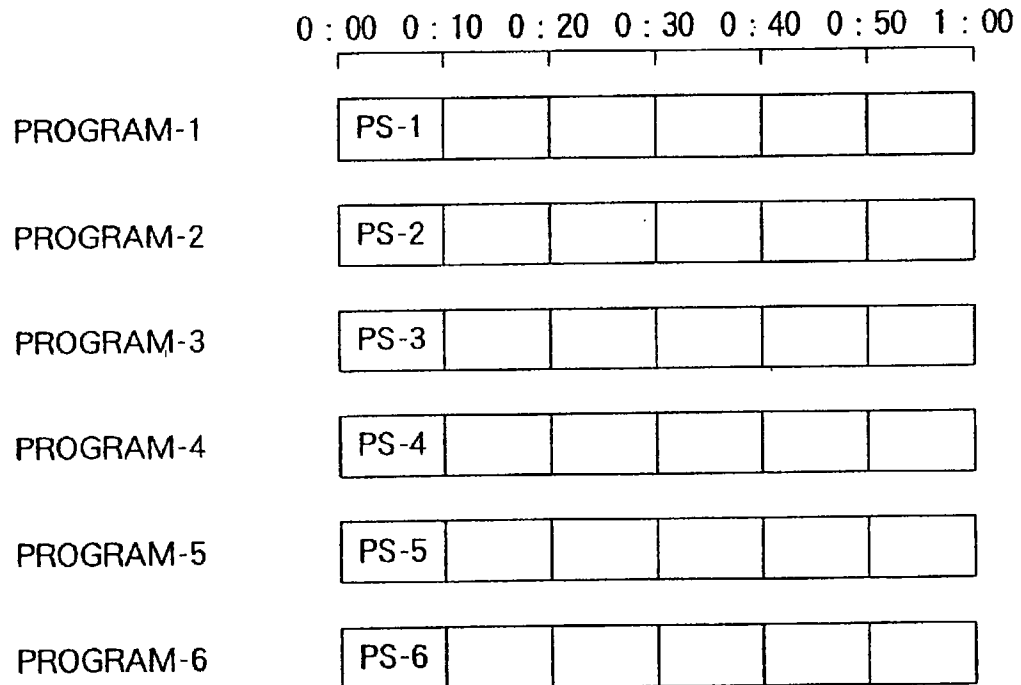


FIG. 3

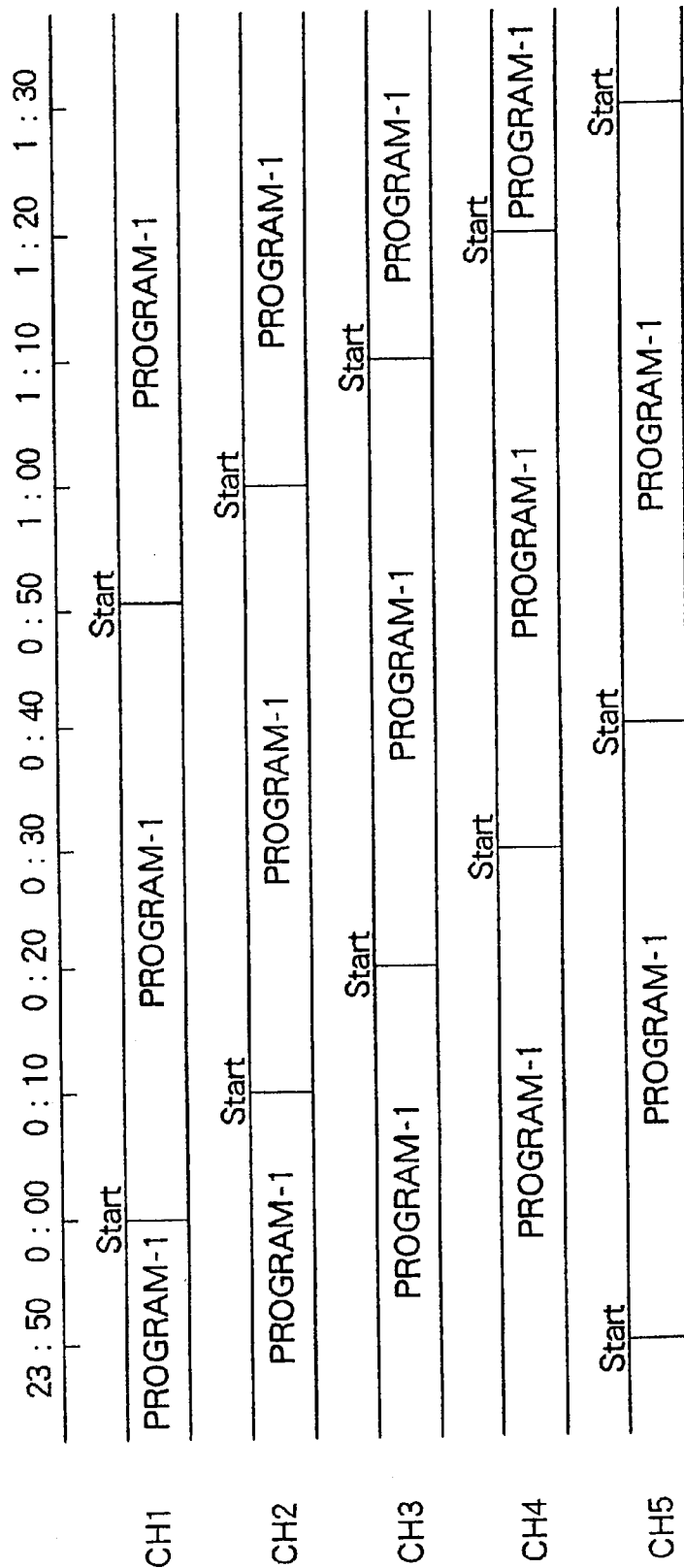


FIG. 4

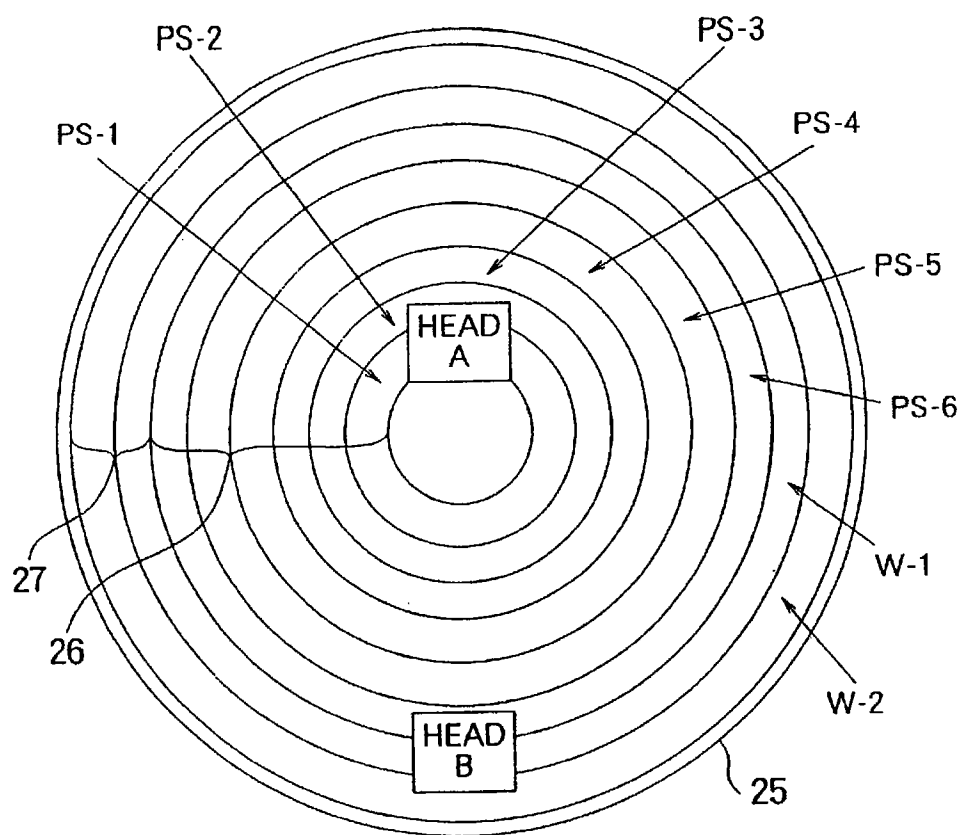


FIG. 5

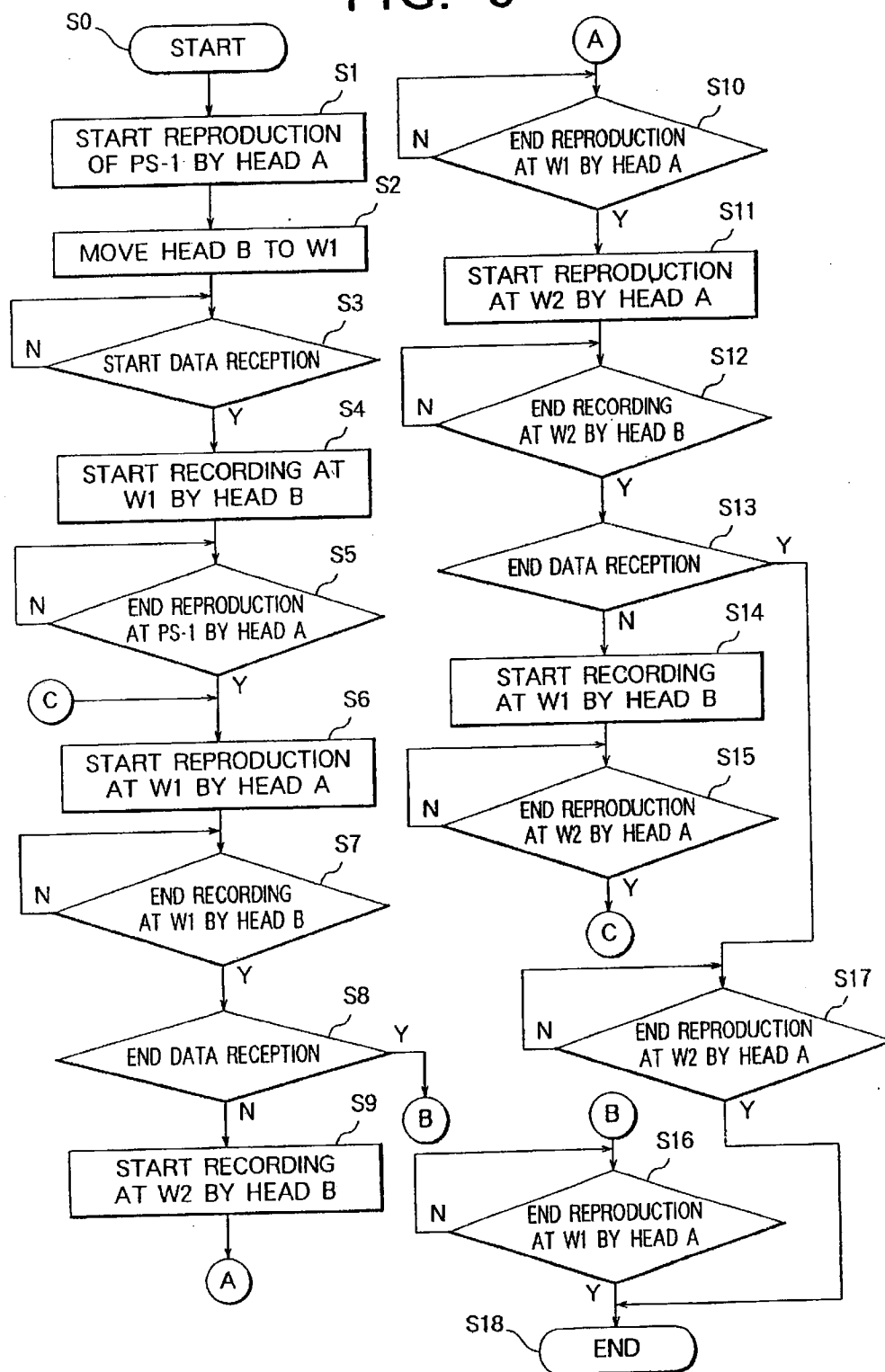


FIG. 6

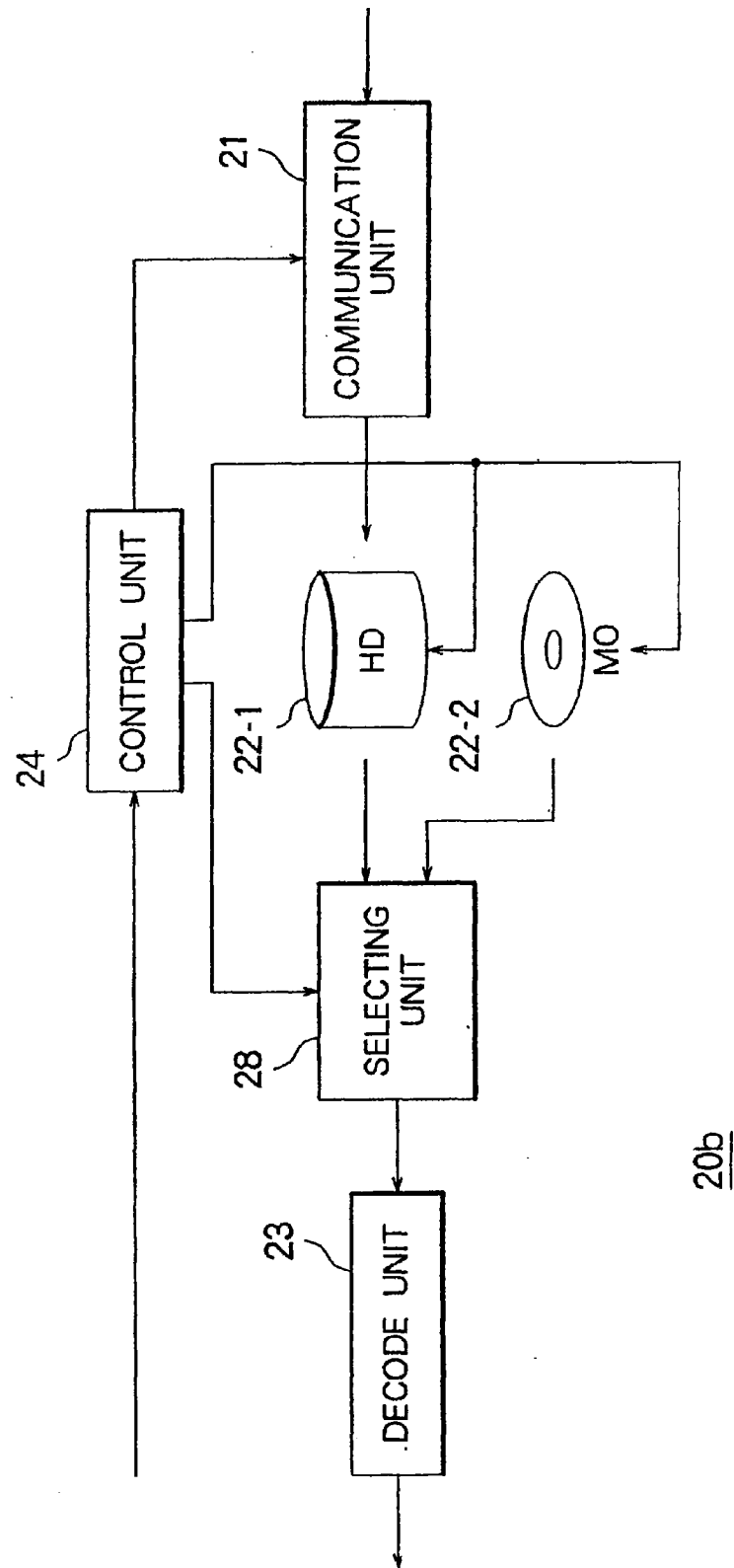
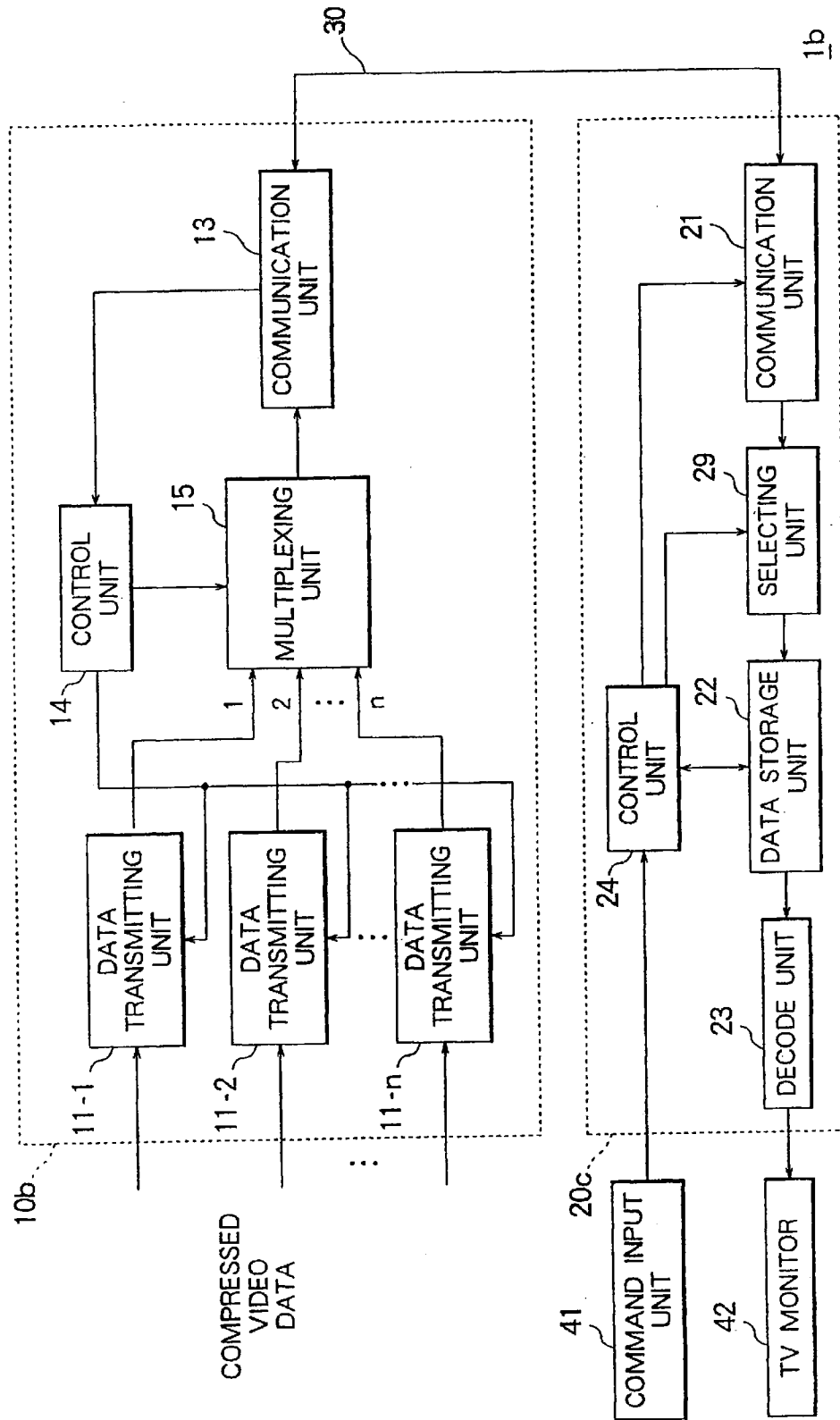


FIG. 7



DATA DELIVERY SYSTEM, DATA RECEIVING APPARATUS, AND STORAGE MEDIUM FOR VIDEO PROGRAMS

This application is a continuation of U.S. application Ser. No. 08/754,268, filed Nov. 20, 1996, U.S. Pat. No. 6,144,400.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a data delivery system, a data receiving apparatus, and a storage medium suitable for use in a video on demand system which can deliver video data in accordance with for example a request generated at any time.

2. Description of the Related Art

There has long been a demand for realization of a practical video on demand (VOD) system which can instantaneously provide a video program in accordance with the request of a receiver. A VOD system able to individually respond to requests generated at any time, however, would require an extremely large sized data transmitting apparatus performing complex processing.

Therefore, a near video on demand (NVOD) system which enables the configuration of the data transmitting apparatus to be simplified while realizing a similar function to that of a VOD system has been proposed. The NVOD system which has been proposed heretofore is a system that transmits a certain program to a plurality of channels at predetermined time intervals, selects a channel at which that program is started from the start from the next time zone in response to a request generated in a certain time zone, and provides that program.

Such an NVOD system, however, due to its basic setup, of course results in a certain waiting time before the receiver can start to view the desired program. This waiting time is tedious for the receiver. Therefore, instantaneous response equivalent to that of a true VOD system is now desired for NVOD systems as well.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a data delivery system suitable for use for a VOD system which can instantaneously provide video data in response to a request with a configuration of hardware equivalent to that of an NVOD system.

Another object of the present invention is to provide a data receiving apparatus which can instantaneously provide video data in response to a request even though receiving transmission of video data similar to that of an NVOD system.

Still another object of the present invention is to provide a storage medium suitable for use for a receiving apparatus of a data delivery system featuring an instantaneous response equivalent to that of a VOD system by a configuration of hardware equivalent to that of an NVOD system.

In order to achieve the above objects, the present invention provides an NVOD system in which a storage device is provided at the user terminal side so as to enable the same service as that by a VOD system to be provided. Namely, the data of the first part of the video data is stored in the receiving apparatus in advance. When there is a request for reproduction, the stored data is immediately reproduced. The data after the first data is delivered in the same way as the NVOD system heretofore and buffered within the receiv-

ing apparatus. This data is reproduced to continue after the data of the first part.

According to a first aspect of the present invention, there is provided a data delivery system which has a transmitting apparatus and a receiving apparatus and sends data forming a video program from the transmitting apparatus to the receiving apparatus, the data delivery system comprising: a first data outputting means provided in the transmitting apparatus for outputting data subsequent to a predetermined time's worth of data at the start of a video program to a plurality of channels staggered by a time zones each comprised of the predetermined time at the longest; a first storage means provided in the receiving apparatus for storing in advance the predetermined time's worth of data of the start of the video program to be delivered; a channel selecting means for selecting the channel at which the data subsequent to the predetermined time's worth of data of the start of the video program will be output earliest from among the plurality of channels in accordance with a request for reception of the video program generated from the receiving apparatus in a certain time zone among the time zones; a second storage means for sequentially storing the data of the selected channel and, at the same time, sequentially reproducing the stored data; and a data reproducing means provided in the receiving means for reproducing the data stored in the first storage means in accordance with the request for reception, sequentially reproducing the data sequentially stored in the second storage means following the reproduction of this data, and thereby restoring the video program.

According to a second aspect of the invention, there is provided a data receiving apparatus which receives data forming a predetermined video program and subsequent to a predetermined time's worth of data of the start of the video program to be delivered is distributed to a plurality of channels staggered by time zones each comprised by the predetermined time at the longest and reproduces the same on a monitor, the data receiving apparatus comprising: a first storage means for storing the predetermined time's worth of data of the start of the video program; a second storage means for sequentially storing data subsequent to the predetermined time's worth of data at the start of the video program selected in accordance with a request for reception of data forming the video program generated in a certain time zone among the time zones and, at the same time, sequentially reproducing the same; and a data reproducing means for reproducing the data stored in the first storage means in accordance with the request for reception and sequentially reproducing the data sequentially stored in the second storage means following the reproduction of this data so as to restore the video program.

According to a third aspect of the present invention, there is provided a recording medium used in a receiving apparatus for reproducing a video program in a data delivery system which distributes data subsequent to a predetermined time's worth of data of the start of a video program to be delivered among a plurality of video programs to a plurality of channels staggered by time zones comprised of the predetermined time at the longest, delivers this distributed data from a transmitting apparatus to the receiving apparatus, and plays back the delivered video program at the receiving apparatus, the recording medium having a means attachable and detachable to and from a recording and/or reproducing means provided in the receiving apparatus and a storage region for storing a predetermined time's worth of data of the start of each of the plurality of video programs being defined.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and features of the present invention will become more apparent from the following description of the preferred embodiments given with reference to the attached drawings, wherein

FIG. 1 is a view of the configuration of a data delivery system according to an embodiment of the present invention;

FIG. 2 is a view of program data provided by a data delivery system shown in FIG. 1;

FIG. 3 is a view of video data output to channels for providing program data shown in FIG. 2 in the data delivery system shown in FIG. 1;

FIG. 4 is a view for explaining a data storage and reproduction system of a data storage unit of the receiving apparatus shown in FIG. 1;

FIG. 5 is a flow chart for explaining a method of access of a data storage medium shown in FIG. 4;

FIG. 6 is a view of the configuration of a modification of the receiving apparatus shown in FIG. 1; and

FIG. 7 is a view of the configuration of a modification of the data delivery system shown in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A preferred embodiment of the present invention will be explained next by referring to FIG. 1 to FIG. 5.

Note that, in the explanation, the processing of the audio data corresponding to the video data was omitted.

FIG. 1 is a block diagram of the configuration of a data delivery system 1 of a video program according to the present embodiment.

The data delivery system 1 is constituted by a transmitting apparatus 10 serving as a host apparatus, a receiving apparatus 20 serving as a user terminal, and a communication path 30 connecting them. To the receiving apparatus 20 is connected a command input unit 41 such as a remote control unit and a TV monitor 42. The viewer carries out an operation such as selection of the program he or she desires to view via the command input unit 41 and views the video data output to the TV monitor 42.

Note that, in the present embodiment, an explanation will be made of the present invention taking as a concrete example a case where six one-hour programs PROGRAM-1 to PROGRAM-6 as shown in FIG. 2 are delivered by this data delivery system 1 so that the reproduction can be carried out from any time.

First, an explanation will be made of the configuration of the data delivery system 1.

The transmitting apparatus 10 comprises n number of data transmitting units 11₋₁ to 11_{-n}, a selecting unit 12, a communication unit 13, and a control unit 14.

The data transmitting units 11₋₁ to 11_{-n} are provided corresponding to the channels 1 to n which can be selected by the viewer and output the video data to the corresponding channels. To the data transmitting units 11₋₁ to 11_{-n}, compressed digital video data to be delivered is input from a not illustrated video data storage device for storage. At this time, assuming that the video data of a program is divided into m number of blocks of data for each time t, the second to m-th blocks of data are respectively stored in the m-1 number of data transmitting units 11₋₁ to 11_{-(i+m-2)}. Namely, the video data except the block of data of the amount of the first time t of the data of that program is stored in the data transmitting units 11₋₁ to 11_{-n}.

Then, based on a control signal input from the control unit 14, video data staggered by the time t is reproduced in the m-1 number of data transmitting units 11_{-n} to 11_{-(i+m-2)}. The video data after the time t is sequentially output to the m-1 number of channels staggered by the time t.

Note that, the time t and the number m divided by are set to adequate values according to the number of the usable channels, the number of the programs to be provided, the storage capacity of the data storage unit 22 of the receiving apparatus 20 mentioned later, etc.

In the present embodiment, the data delivery system 1 sends six one-hour programs PROGRAM-1 to PROGRAM-6 as shown in FIG. 2. For this purpose, first, the 50 minutes of video data from the 10th minute to 60th minutes of each program is input to five data transmitting units 11₋₁ to 11_{-(i+4)} from the video data storage device. Namely, the 50 minutes of video data of the program PROGRAM-1 is input to the first to fifth data transmitting units 11₋₁ to 11_{-n}; the 50 minutes of video data of the program PROGRAM-2 is input to the sixth to 10th data transmitting units 11₋₆ to 11₋₁₀; the 50 minutes of video data of the program PROGRAM-3 is input to the 11th to 15th data transmitting units 11₋₁₁ to 11₋₁₅; the 50 minutes of video data of the program PROGRAM-4 is input to the 16th to 20th data transmitting units 11₋₁₆ to 11₋₂₀; the 50 minutes of video data of the program PROGRAM-5 is input to the 21st to 25th data transmitting units 11₋₂₁ to 11₋₂₅; and then the 50 minutes of video data of the program PROGRAM-6 is input to the 26th to 30th data transmitting units 11₋₂₆ to 11₋₃₀.

Then, for each program, video data staggered by 10 minutes each is reproduced at the data transmitting units 11_{-i} to 11_{-(i+4)} (i=1, 6, 11, 16, 21, 26). For example, for the program PROGRAM-1, five data streams each staggered by 10 minutes as shown in FIG. 3 are generated and output to the channels.

Note that, in the present embodiment, the video data to be input to the data transmitting units 11₋₁ to 11_{-n} is made data compressed by the MPEG2 system (system of coding moving pictures of the Moving Picture Experts Group).

Further, the data transmitting units 11₋₁ to 11_{-n} are constituted by high speed accessible hard magnetic disc devices.

The selecting unit 12 selects one stream of video data from among the streams of video data output to the n number of channels from the n number of data transmitting units 11₋₁ to 11_{-n}, and outputs the same to the communication unit 13.

The communication unit 13 carries out the communication of the data and the control signal with the receiving apparatus 20. Concretely, it encodes the data and control signal to be transmitted to the receiving apparatus 20 to coded data for communication, transforms the same to the data format according to the predetermined communication protocol, and transmits this to the communication path 30. Further, the data part is extracted from the signal received by the receiving apparatus 20 according to the protocol and decoded to the original data and the control signal.

By this, the video data selected at the selecting unit 12 is transformed to the communication use data at the communication unit 13 and transmitted via the communication path 30 to the receiving apparatus 20. Further, the control signal received from the receiving apparatus 20 mentioned later is decoded at the communication unit 13 and input to the control unit 14.

The control unit 14 controls the parts of the transmitting apparatus 10 to make them perform the desired operations. For example, based on the program selection signal input from the receiving apparatus 20 via the communication path

30 and the communication unit 13, it controls the selecting unit 12 to detect the channel through which the video data of the program selected by the signal will be output and from which the output of the video data after the time t of that program will be started earliest and transmit the video data of that channel to the receiving apparatus 20.

The receiving apparatus 20 comprises a communication unit 21, a data storage unit 22, a decode unit 23, and a control unit 24.

The communication unit 21 carries out the communication of the data and the control signal with the transmitting apparatus 10. Concretely, it encodes the data and control signal to be transmitted to the transmitting apparatus 10 to coded data for communication, transforms the same to the data format according to the predetermined communication protocol, and transmits this to the communication path 30. Further, a data part is extracted from the signal received from the transmitting apparatus 10 according to the protocol and decoded to the original data and the control signal.

By this, the control signal, for example, the program selection signal, input from the control unit 24 mentioned later is transformed to the data for communication at the communication unit 21 and transmitted via the communication path 30 to the transmitting apparatus 10. Further, the video data of the program selected program received from the transmitting apparatus 10 is decoded at the communication unit 21 and input to the data storage unit 22.

The data storage unit 22 stores the video data of the start of the program to be delivered in advance and, at the same time, temporarily stores the video data transmitted from the transmitting apparatus 10. It appropriately selectively reproduces the video data so as to output all video data of the desired program to the viewer to enable viewing. In the present embodiment, the data storage unit 22 is a magneto-optic (MO) disc device.

The storage region of the data storage unit 22 is constituted by a head data storage region 26 and a reception data storage region 27. In the head data storage region 26, the predetermined time t worth of the video data of the start of the program to be delivered is stored in advance for every program to be sent. The reception data storage region 27 is further divided into a plurality of smaller storage regions.

Further, the data storage unit 22 accesses the MO disc, that is, the storage medium, by two heads A and B. These plurality of heads independently access the storage regions so the reading and writing of the data can be simultaneously carried out.

The storage format of the video data on the MO disc 25 in the present embodiment is shown in FIG. 4.

As shown in FIG. 4, in the present embodiment, the MO disc 25 is divided for each storage track to set up separate regions. More specifically, the head data storage region 26 is secured in an inner circumferential portion of the MO disc 25, and the reception data storage region 27 is secured in an outer circumferential portion thereof. In the head data storage region 26, video data PS-1 to PS-6 of the first 10 minutes of each of the six programs PROGRAM-1 to PROGRAM-6 shown in FIG. 2 are stored from the inner circumferential portion in order. Further, the reception data storage region 27 is divided into two smaller storage regions W-1 and W-2.

Note that, in the present embodiment, the MO disc 25 on which the data of the starting part of the six programs PROGRAM-1 to PROGRAM-6 as shown in FIG. 4 are stored in advance is delivered from the program sending side. That MO disc is set in the MO disc device. This constitutes the data storage unit 22.

The decode unit 23 decodes the compressed digital video data output from the data storage unit 22, transforms the same to a signal which can be output to the TV monitor 42, and outputs the same to the TV monitor 42. In the present embodiment, the video signal compressed by the MPEG2 is input from the data storage unit 22. Therefore, the decode unit 23 decodes that signal and transforms it to an analog video signal of the NTSC system which can be displayed on a usual TV monitor 42.

Next, an explanation will be made of the operation of such a video data delivery system 1.

When a viewer uses the command input unit 41 to select a program, for example, PROGRAM-1, from among the programs to be delivered, due to the control of the control unit 24 of the receiving apparatus 20, the video data PS-1 of the first 10 minutes of the program PROGRAM-1 stored on the MO disc 25 of the data storage unit 22 in advance is immediately reproduced, decoded at the decode unit 23, and output to the TV monitor 42. By this, the audience can view the selected program immediately after the request.

Simultaneously with that processing, the control unit 24 requests transmission of the data starting after the 10 minutes of that program PROGRAM-1 from the transmitting apparatus 10 via the communication unit 21.

The transmission request signal for the video data of that program PROGRAM-1 input to the transmitting apparatus 10 via the communication path 10 is input via the communication unit 13 to the control unit 14. The control unit 14 controls the selecting unit 12 so as to find the channel at which the video data starting after the 10 minutes of the program PROGRAM-1 is output earliest from among the n number of channels of video data transmitted from the n number of data transmitting units 11₁ to 11 _{n} , and selects that channel of the video data.

The video data selected at the selecting unit 12 is immediately transmitted to the receiving apparatus 20 while being coded to the communication use code at the communication unit 13.

The receiving apparatus 20, when receiving the video data starting after the 10 minutes of the program PROGRAM-1 from the transmitting apparatus 10, sequentially stores this by the head B in the first storage region W-1 of the reception data storage region 27 of the MO disc 25 of the data storage unit 22. When the data for 10 minutes, that is, from the 10th minute to the 20th minute of the program PROGRAM-1, is stored in the first storage region W-1, the reception video data is subsequently stored by the head B in the second storage region W-2. Thereafter, similarly, 10 minute portions of video data are sequentially stored in the first storage region W-1 and the second storage region W-2. Note that, when storing the data again in the same storage region, the previously stored data is updated and subsequently erased, but as will be mentioned later, the previous data has been read out by the head A at that time, so there is no problem.

On the other hand, the receiving apparatus 20, when the reproduction of the video data PS-1 of the start of the program PROGRAM-1 is ended by the head A, then subsequently reproduces the data of the first storage region W-1. This is decoded at the decode unit 23 and output to the TV monitor 42. When this head A accesses the first storage region W-1, the data received from the transmitting apparatus 10 has been already stored in that first storage region W-1. Accordingly, the video data starting after the 10 minutes received from the transmitting apparatus 10 is reproduced continuously with the video data up to the 10 minutes of the program PROGRAM-1 stored in the MO disc 25 in advance and output to the TV monitor 42.

Next, a detailed explanation will be made of storage and reproduction operation of the video data with respect to the MO disc 25 of the data storage unit 22 in such an operation of the data delivery system 1 referring to the flow chart of FIG. 5.

In the data storage unit 22, when a viewer carries out an operation for selecting the program PROGRAM-1 (Step S0), first, the reproduction of the video data PS-1 of the first 10 minutes of the program PROGRAM-1 is started by the head A (Step S1). Further, simultaneously with this, the head B is moved to the position of the first storage region W-1 of the reception data storage region 27 and made to wait in a data write enable state (Step S2). The reception of the requested desired data is awaited (Step S3). Then, when the reception of that data, that is, the video data starting after the 10 minutes of the program PROGRAM-1 selected by the viewer, is started, that reception data is sequentially stored in the first storage region W-1 of the reception data storage region 27 of the MO disc 25 by the head B (Step S4).

Next, in the data storage unit 22, when the end of the reproduction of the video data of the first 10 minutes of the program PROGRAM-1 started at step S1 is detected (Step S5) and the reproduction is ended, the head A is moved to the position of the first storage region W-1, where the reproduction of the received video data stored from step S4 is started (Step S6).

Then, at this time, the end of the writing of the received video data into the first storage region W-1 started from step S4 by the head B is detected (Step S7). In this case, in either of the case where 10 minutes' worth of video data of the received video data is stored or where the reception of the video data is ended, it is decided that the writing of the data to the first storage region W-1 is ended. Then, when the end of the writing is detected at step S7, it is decided whether or not the ending of writing is due to the end of reception of the video data (Step S8). When not due to the end of the reception of the video data, that is, when the video data of the program PROGRAM-1 continues to be received, the storage of the received video data to the second storage region W-2 is started by the head B (Step S9).

Further, at step S8, where it is decided that the writing of the data into the first storage region W-1 is ended due to the end of the reception of the video data, the writing of the data by the head B is ended as it is, and the end of the reproduction of the data of the first storage region W-1 by the head A started from step S6 is awaited (Step S16). When the reproduction is ended, this means that the reproduction of all video data of the program PROGRAM-1 is ended, so one series of processing in accordance with the request for viewing the program PROGRAM-1 by the viewer is ended (Step S18).

When the storage of the video data received at the second storage region W-2 by the head B is performed from step S9, the end of the reproduction of the video data of the first storage region W-1 by the head A is awaited (Step S10). When the reproduction is ended, the reproduction of the second storage region W-2 is subsequently started by the head A (Step S11).

Then, this time, the end of the writing of the received video data into the second storage region W-2 started by the head B from step S9 is detected (Step S12). When the end of writing is detected, it is further decided whether or not the end of the writing is due to the end of the reception of the video data (Step S13), and where it is not due to the end of the reception of the video data, that is, where the video data of the program PROGRAM-1 is continuously received, the

storage of the received video data to the first storage region W-1 is started again by the head B (Step S14).

At step S13, where it is decided that the writing of the data into the second storage region W-2 has been ended due to the end of reception of the video data, the writing of the data by the head B is ended as it is, the end of the reproduction of the data of the second storage region W-2 by the head A started from step S11 is awaited (Step S17), and one series of processing is ended (Step S18).

When the storage of the video data received at the first storage region W-1 by the head B is performed from step S14, the end of the reproduction of the video data of the second storage region W-2 by the head A is awaited (Step S15). When the reproduction is ended, the reproduction of the first storage region W-1 is started by the head A (Step S6).

Below, similarly, the processing after step S6 is repeated. Then, as mentioned before, the end of the reception video data is detected at step S8 or step S13, and the received video data are all reproduced at step S16 or step S17, whereby all processing of the reproduction of the program PROGRAM-1 is ended.

As explained above, in the data sending system 1 of the present embodiment, a desired program can be immediately provided to the viewer from the point of time when the request is made even though the system configuration is almost equal to that of an NVOD system heretofore. Namely, the function of a VOD system can be realized.

Further, in the data delivery system 1 of the present embodiment, while it is necessary to provide a means for newly storing the video data in the receiving apparatus, this means is a means for storing short, high efficient coded digital video data, therefore can be sufficiently constituted by an already existing hard magnetic disc device, MO disc device, or the like. Further, in the data delivery system 1 of the present embodiment, it is not necessary to transmit the video data stored in the storage means in the receiving apparatus, so the number of channels necessary for transmission can be reduced. Due to this, the size of the hardware becomes almost equivalent to that of the NVOD system heretofore.

Note that, the delivery system of the present invention is not limited to the present embodiment. Various modifications are possible.

For example, in the data delivery system of the present invention, it is necessary to store the data of the starting part of the video data to be delivered in the receiving apparatus in advance. In the present embodiment, an MO disc on which such data of the starting parts of a plurality of programs were stored in advance was delivered from the program sending side. By setting the MO disc in the receiving apparatus, the data was input into the receiving apparatus. However, it is also possible to configure the system so as to transmit the data of the starting part of the video data to be delivered in advance using the transmission path for sending the video data and store it.

Further, it is also possible to adopt a configuration in which the data of the starting part of the video data to be delivered is stored in the storage medium, for example, a data stream tape, DAT, or VTR tape and delivered, and the data of these storage media is loaded on the reception side and fetched into the receiving apparatus.

Further, the data storage unit in that receiving apparatus is not limited to an MO disc device and can be constituted by any storage device such as a hard magnetic disc device.

Further, it is also possible to constitute the storage means for storing the data of the starting part of the video data to

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be sent and the storage means for storing and reproducing the received video data by different storage means. A concrete example of the receiving apparatus given such a configuration is shown in FIG. 6.

In the receiving apparatus **20b** shown in FIG. 6, the data storage unit **22** is constituted by a first data storage unit **22₁** composed by a hard magnetic disc device and a second data storage unit **22₂** composed by an MO disc device. In the second data storage unit **22₂**, the MO disc on which the data of the starting part of the video data to be sent delivered from the sending side is mounted and used for the reproduction of the video data of the starting part of each program. Further, the first data storage unit **22₁** is used for the storage and reproduction of the video data transmitted from the transmitting apparatus via the communication path.

Outputs of such first data storage unit **22₁** and the second data storage unit **22₂** are appropriately selected at the selecting unit **28** and output.

When adopting such a configuration, an MO unit device having portability and a large capacity and high speed access hard magnetic disc device can be adequately used and so a more preferred receiving apparatus can be constructed.

Further, in the data storage unit of the receiving apparatus of the present embodiment, by accessing the storage medium by two heads, the storage and reproduction of the data are simultaneously carried out. If the data storage unit can perform a sufficiently high speed access, however, it is also possible to perform the operations of the storage and reproduction by one head in a time division manner. Further, it is also possible to access it using two or more heads.

Further, in the data delivery system **1** of the present embodiment, one channel was selected from a plurality of channels from which the video data were output within the transmitting apparatus based on the signal transmitted from the receiving apparatus and transmitted to the receiving apparatus. However, it is also possible to transmit the video data of a plurality of channels to the receiving apparatuses as they are from the transmitting apparatus and select a desired channel from among the plurality of channels on the receiving apparatus side.

A video data delivery system **1b** having such a configuration is shown in FIG. 7.

In the transmitting apparatus **10b** of FIG. 7, the video data output from *n* number of data transmitting units **11₁** to **11_n** are multiplexed at a multiplexing unit **15**, and the multiplexed video data are transmitted from the communication unit **13** to the receiving apparatus **20a** via the communication path **30**.

Then, at the selecting unit **29** of the receiving apparatus **20c**, based on the input program selection signal, a desired channel is selected from among the *n* number of channels of transmitted video data and the selected channel of the video data is output to the data storage unit **22**.

When adopting such a configuration, in the transmitting apparatus **10c**, it is not necessary to transmit the video data for each receiving apparatus **20**. The same multiplexed video data may be transmitted to all receiving apparatuses of the users.

According to the data delivery system of the present invention, an environment of an VOD system can be provided with a system configuration equivalent to that of an NVOD system. Namely, the system with which immediate viewing of a program becomes possible at any time can be constructed by a simple system configuration.

Further, according to the video data receiving apparatus of the present invention, immediate viewing of a program can

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be made possible from a point of time when the viewer requests it while receiving the video data sent staggered by predetermined times in the same way as an NVOD system.

What is claimed is:

1. A data delivery system in which a transmitting apparatus sends a program including video and/or audio data to a receiving apparatus in response to a request therefrom, said data delivery system comprising:

communication means provided in said receiving apparatus for sending said request for said program to said transmitting apparatus;

communication means provided in said transmitting apparatus for receiving said request for said program from said receiving apparatus;

data output means provided in said transmitting apparatus for outputting first data corresponding to a predetermined time's worth of data at the start of said program, and outputting to a plurality of channels second data corresponding to the remainder of the program subsequent to said first data; each channel being staggered by a time zone which is less than said predetermined time; said second data being output in response to said request from said receiving apparatus;

channel selecting means for selecting the channel from amongst said plurality of channels whose second data starts earliest in response to said request from said receiving apparatus;

storing means provided in said receiving apparatus for storing said first data and said second data in a hard-disk; and

reproducing means provided in said receiving apparatus for reproducing said first data stored in said storing means and reproducing said second data stored in said storing means subsequent to the reproduction of said first data.

2. A data delivery system in which a transmitting apparatus sends a program including video and/or audio data to a receiving apparatus in response to a request therefrom, said data delivery system comprising:

communication means provided in said receiving apparatus for sending said request for said program to said transmitting apparatus;

communication means provided in said transmitting apparatus for receiving said request for said video program from said receiving apparatus;

data output means provided in said transmitting apparatus for outputting to a plurality of channels a remaining portion of said program subsequent to a predetermined time's worth of data at the start of said program; each channel being staggered by a time zone which is less than said predetermined time; said remaining portion being transmitted in response to said request from said receiving apparatus;

channel selecting means for selecting the channel from amongst said plurality of channels whose remaining portion will be output earliest in response to said request from said receiving apparatus; and

reproducing means provided in said receiving apparatus for reproducing from disk media said predetermined time's worth of data at the start of said program and said remaining portion of said program output from said transmitting apparatus.

3. A data delivery system as set forth in claim 2, wherein said disk media is removable media.

* * * * *



US006091883A

United States Patent [19][11] **Patent Number:** **6,091,883****Artigalas et al.**[45] **Date of Patent:** ***Jul. 18, 2000**[54] **METHOD AND DEVICE FOR RECORDING AND READING ON A LARGE-CAPACITY MEDIUM**[75] Inventors: **Max Artigalas, Le Chesnay;**
Paul-Louis Meunier; Alain Staron,
both of Paris, all of France[73] Assignee: **Thomson multimedia S.A., France**

[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

[21] Appl. No.: **08/675,364**[22] Filed: **Jul. 2, 1996**[30] **Foreign Application Priority Data**

Jul. 13, 1995 [FR] France 95 08558

[51] **Int. Cl.⁷** **H04N 5/76**[52] **U.S. Cl.** **386/83; 386/92**[58] **Field of Search** 386/83, 46, 92,
386/63, 94, 109, 111, 112, 27, 33, 52, 95,
4; 360/32, 15; H04N 5/76[56] **References Cited****U.S. PATENT DOCUMENTS**

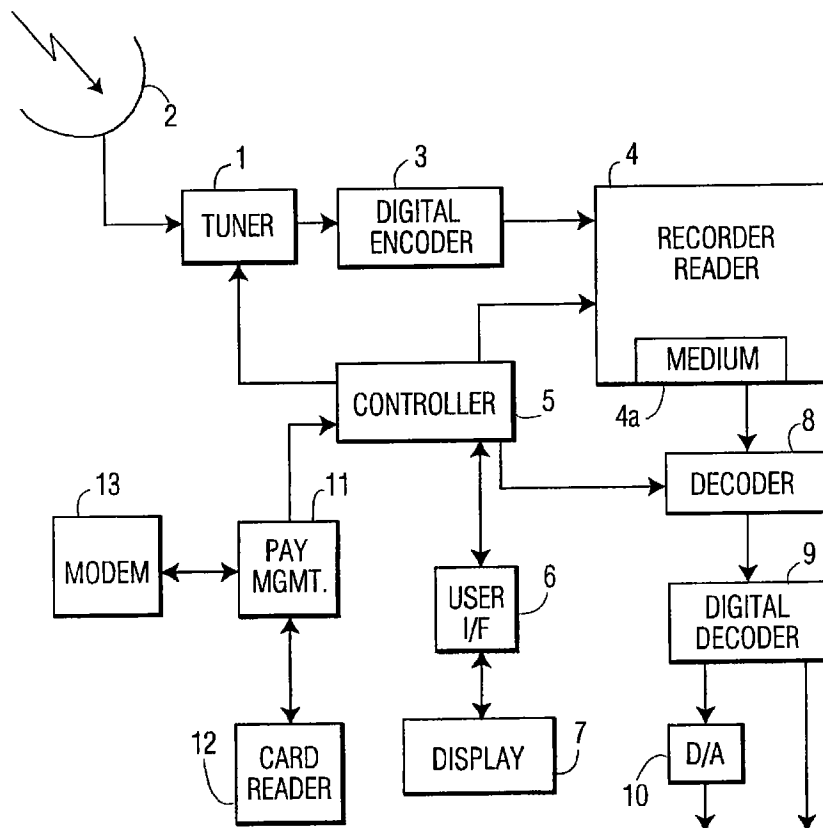
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Primary Examiner—Robert Chevalier*Attorney, Agent, or Firm*—Joseph S. Tripoli; Frederick A. Wein[57] **ABSTRACT**

The disclosure relates to a recording and reading apparatus constituting a kind of video reservoir in the home of the consumer. Thanks to a large-capacity storing technique with suitable technical device, broadcasters transmit numerous programs via specific channels and the consumer may control the content of his reservoir (by recording, reading and erasing programs). The invention is applicable to on-demand video in the consumer's home with a video reservoir constituting a video-library that is regularly updated by broadcasters and/or by the consumer himself.

16 Claims, 3 Drawing Sheets

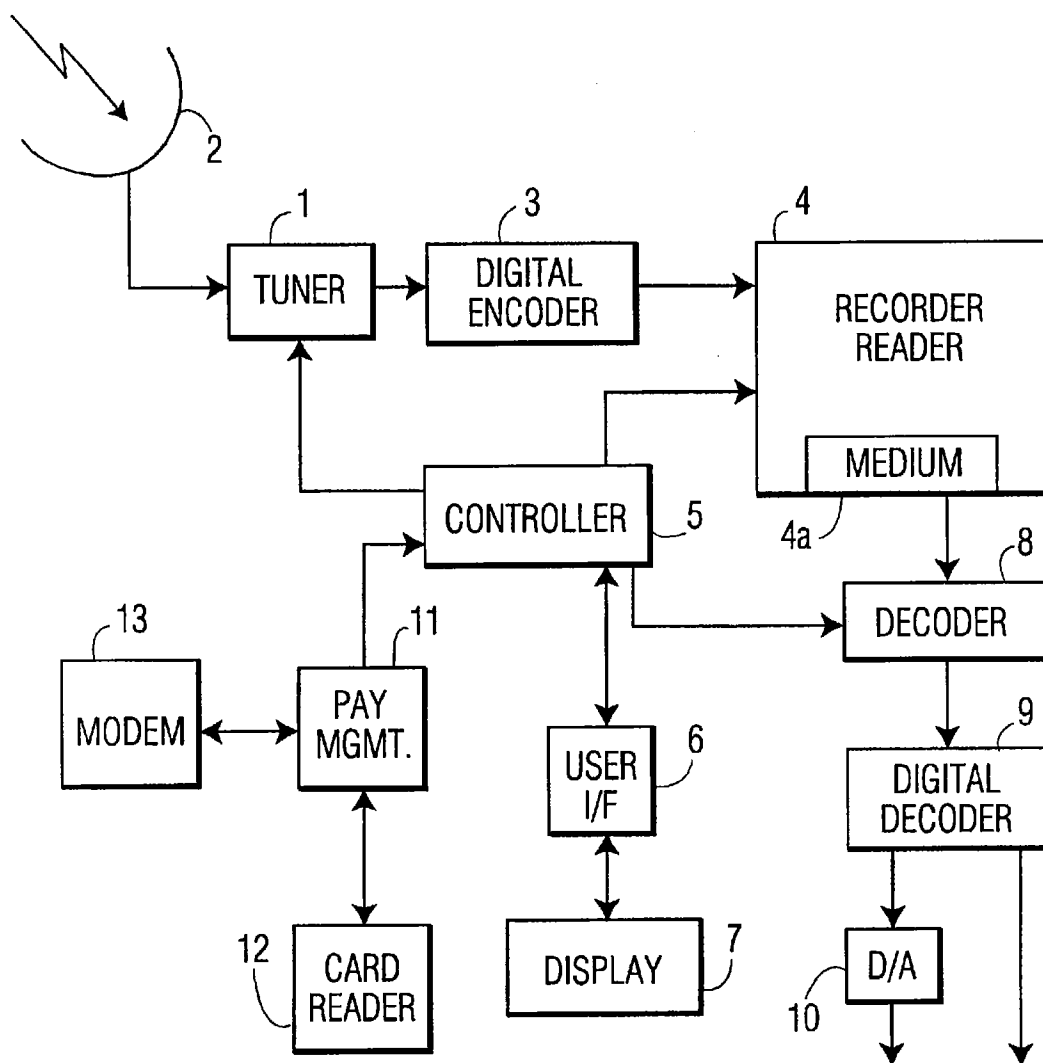


FIG. 1

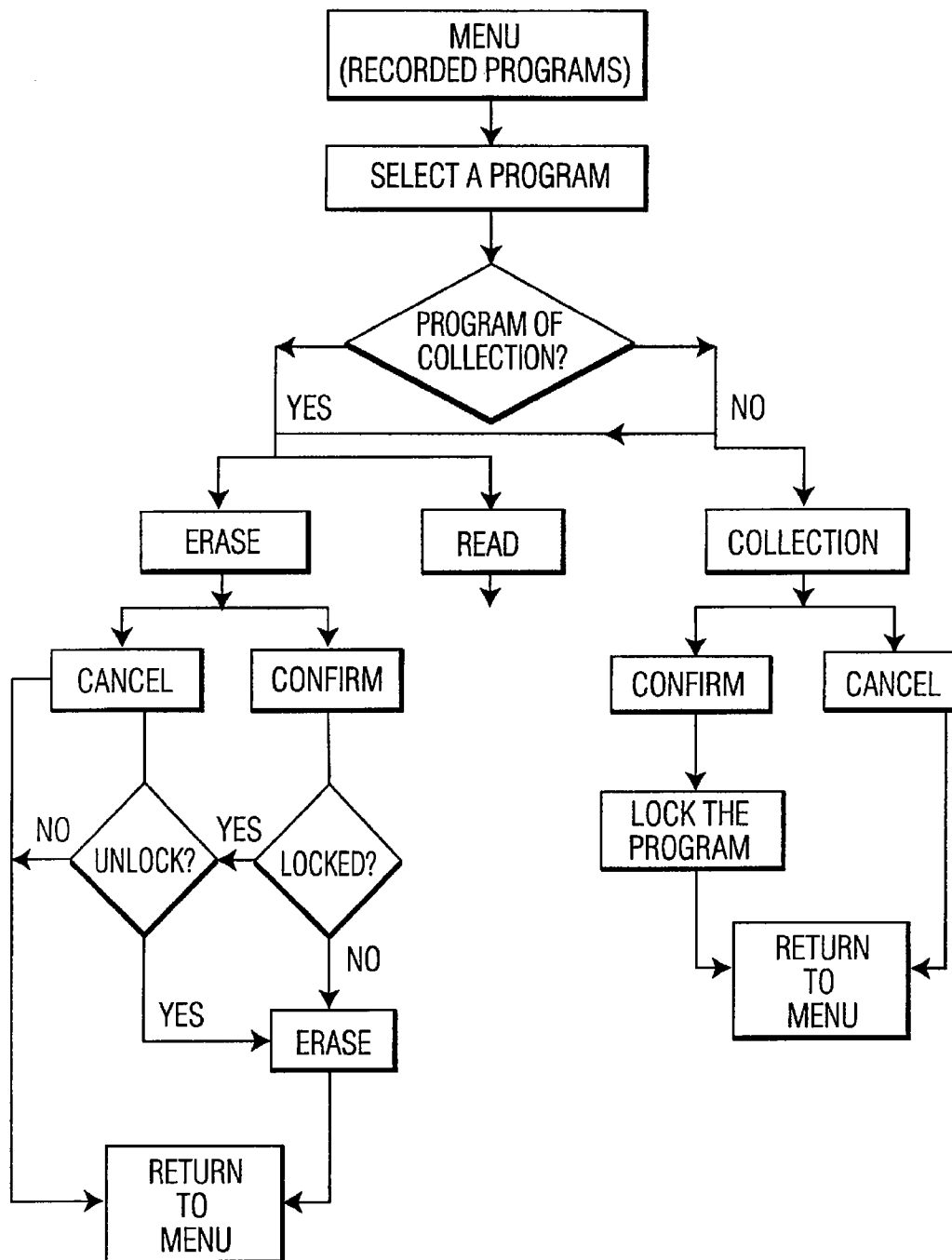


FIG. 2a

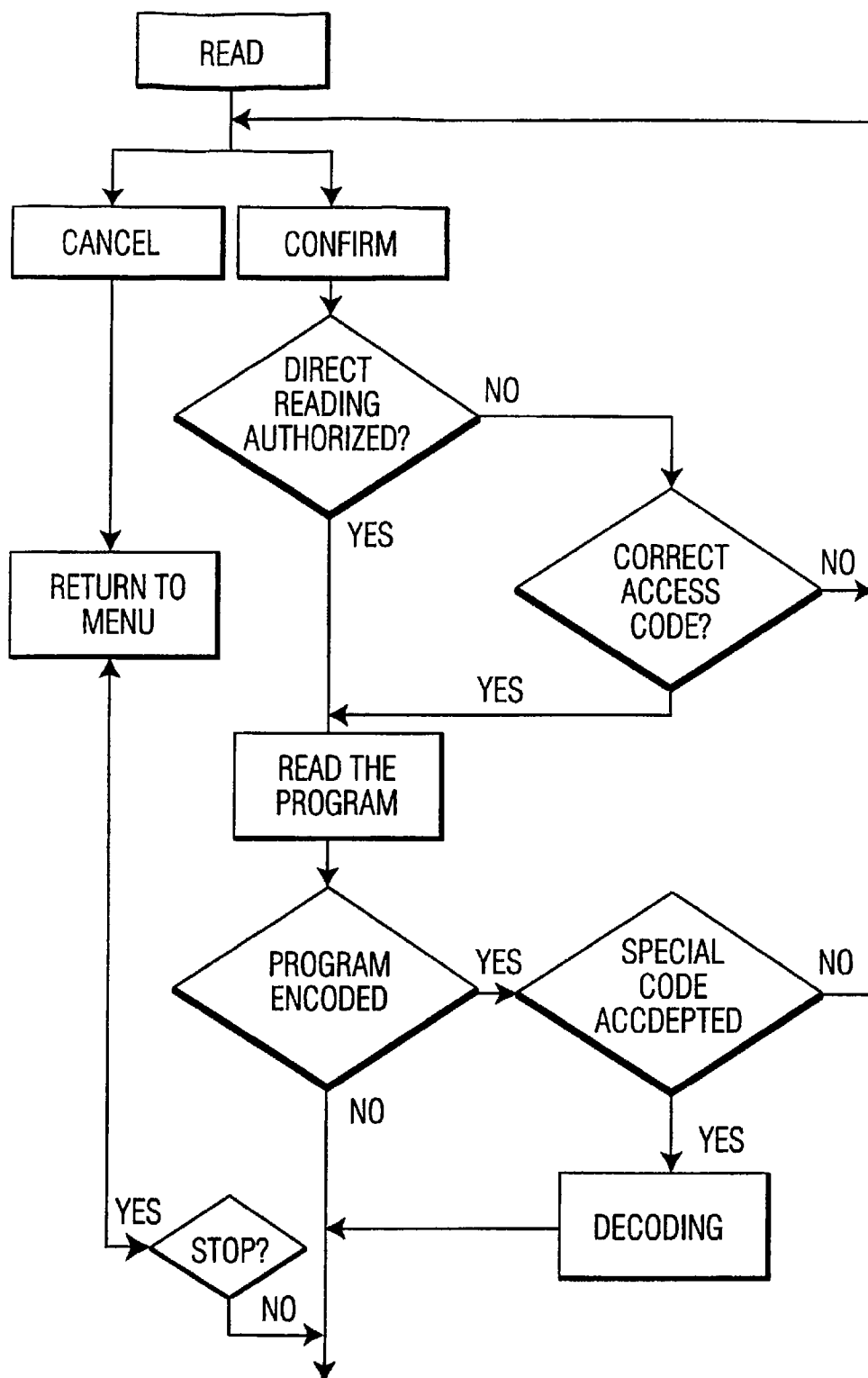


FIG. 2b

METHOD AND DEVICE FOR RECORDING AND READING ON A LARGE-CAPACITY MEDIUM

BACKGROUND OF THE INVENTION

The present invention concerns a method and a device for recording and reading audio and/or video information broadcast as individual programs on one or more channels by air broadcasting, satellite or cabled network.

DESCRIPTION OF THE PRIOR ART

Recent developments of audiovisual techniques have led, in a number of countries, to a choice of TV programs exceeding the viewers' capacity to view all the programs of interest. This is particularly noticeable in countries having satellite TV, notably providing digital transmissions, and cable networks. In practice a TV viewer watches only one channel at a time, possibly recording another program on his video cassette recorder (VCR) at the same time.

A problem arises when the viewer is interested in several programs broadcast at the same time or when several members of his family with different tastes share the same TV set. To resolve this problem, one solution would be simply to acquire more TVs and VCRs, but this solution is costly and the correction and use of several recorders in parallel can be problematic.

A viewer may also wish to record a number of TV programs when he is not watching the television (during the day when he is at work or during the night). The present solution is to program the video recorder to record sequentially in time a number of programs selected in advance. However, a problem arises if the programs are not broadcast at the time announced; there is also the problem of the limited recording capacity (a few hours at most) of present video cassettes. These constraints seriously limit the freedom of the user to record programs of interest.

In parallel with a rapid increase in the number of TV channels broadcast live, a number of supplementary services are now offered. For example, "on-demand video" services enables the consumer to select a movie in a server system that then starts sending the program to the user in exchange for a payment. Such a system requires a server of large-capacity and a wide band network in order to be able to respond to simultaneous requests for different movies from a large number of consumers. The consumer is totally dependent on the state of operation of the network and the catalogue of the movies offered by the server.

SUMMARY OF THE INVENTION

The present invention proposes a technique that enables a consumer to have a large-capacity recording device at home to in order to be able to build a personal video and/or audio library.

Another object of the invention is to offer the consumer a genuine on-demand video service in which he totally controls the selection and display of the programs from his own video reservoir.

Another object of the invention is to enable the program supplier to assure the revenues generated by his programs by controlling the access to video and/or audio programs recorded consumer's recording device, and/or by encrypting the broadcast programs.

Another object of the invention is to enable the consumer to control access to his video and/or audio reservoir by means of a personal access code, and/or limit his expendi-

ture on decoding of certain of the recorded programs by choosing only to display or listen to program of interest.

Another object of the invention is to enable the consumer to constitute a video or audio library in his recording device whose content is controlled by the consumer.

Another object of the invention is to offer a video and/or audio reservoir whose content is regularly updated by the broadcasters, the consumer being able to watch recorded programs during the update of the content of his video and/or audio reservoir.

The invention is therefore a method of recording and reading audio and/or video information broadcast as individual programs via one or several channels by air broadcasting, satellite or cable network. The method comprises the following steps:

- select at least one channel to receive;
- digitally encode the received signals;
- record the encoded digital signals on a large-capacity recording medium;
- create an index on the recording medium for each individual program recorded;
- create at least one menu of recorded programs;
- select one or several programs from a menu of recorded programs displayed on a screen;
- read said selected program(s);
- decoding the signals read;
- reproduce the corresponding audio and/or video information.

The received signals may be either analog or digital. In the case of analog signals received, an analog to digital conversion is done.

The method can include an access control stage to enable reading of at least one of the recorded programs. The use of one or more access codes enables access to the recorded programs to be modulated by applying criteria defined by broadcasters and by the consumer. In this way the broadcasters can control the access to certain types of programs, and modulate the amount of the subscription that the consumer must pay to obtain access to these programs. The same applies when several broadcasters offer programs with different subscriptions from one broadcaster to another. On the user side, the access code enables him to totally prevent other persons from accessing the service, or prevent children accessing programs intended only for adults.

The method of the invention also provides the possibility of recording encoded programs and decoding them during the reading by means of a specific code, in order to reproduce the sound or images. Such a service enables the consumer to control his expenditure on decoding of certain of the recorded programs. The specific code could be the number of his bank card or credit card, so that he pays each time he wishes to decode a program.

The recording and reading functions are advantageously independent of each other, in order to allow reading of one or more recorded programs while recording other programs. The consumer is then able to update the content of his video and/or audio reservoir at any time.

The method preferably enables programs designated by the user to be locked, so that they can not be erased. In this way the user can build up a personal collection of protected recordings. To delete one of the recordings, the user must first unlock it, then erase it from the recording medium.

Advantageously, the method enables simultaneous recording and/or reading of several programs in order to enable the user more rapid updating of his video and/or

audio reservoir, and greater flexibility in the restitution of recorded programs, for example by using several televisions sets in parallel to display several recorded programs at the same time. The same applies for audio programs. Several members of the family can then view or listen to the recorded programs independently in different rooms.

The invention also includes a recording and reading device, referred to as a "video and/or audio reservoir", implementing the method according to the invention, this device including:

- means of reception frequency selection enabling reception of one or more broadcasting channels simultaneously;
- means of digital encoding of the received signals;
- means of recording and reading said encoded digital signals;
- means of control enabling the recording and reading of programs to be controlled independently;
- means of processing the signals read in order to reproduce the sound and/or image (possibly with the ability to read and reproduce in parallel several recorded programs, simultaneously and independently from one another).

Said means of recording and reading must include a large-capacity recording medium in order to enable a "reservoir" to be constituted. The reservoir must be capable of storing a large number of video and/or audio programs (music, news, conferences, etc.).

The French patents N°2 630 853, N°2 656 723 and N°2 699 724 describe a technique of recording and reading on a magnetic tape that enables the storage of a large amount of information. Schematically, the technique uses a magnetic tape that moves over a static magnetic recording head composed of a matrix of $N \times M$ individual recording elements ($N \geq 2$ and $M \geq 1$). By using protocols of excitation of the individual recording elements it is possible to record up to N parallel tracks of information. For the reading of the magnetic tape, a static magneto-optical head enables polarized light to be projected on the magnetic tape which, by the Kerr effect changes the optical polarization when it is reflected from the magnetic tape as a function of the magnetic polarization of the illuminated tracks. A sensor converts the reflected polarized light into a stream of binary numbers representing the data recorded on the N parallel tracks. The patents mentioned above contain more detail of the technique concerned which, by use of the matrix head, enables recording and reading on N parallel tracks on the magnetic tape, simultaneous, independent recording and reading of several programs, and increase of the storage capacity of a 8 mm magnetic tape cassette up to about a hundred hours of video programs.

It is also possible to use the technique of the digital video cassette to build the video and/or audio reservoir. The technique consists in recording and reading information on a magnetic tape by means of a rotating head. Using digital compression, the cassette is capable of storing up to several tens of hours of video programs. Given that the recording and reading data rate on the cassette is several times greater than the broadcasting rate of video programs on a channel (1 to 8 Mbits/s), it is possible to envisage the recording in parallel of several programs by means of a special multiplexing protocol, and the reading of these programs in parallel by means of a demultiplexing protocol. The user can then view one or more programs that are read in parallel.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and other advantages and characteristics will become clear on reading the

following detailed description of an embodiment, taken only as a non-limitative example, making reference to the appended figures, of which:

FIG. 1 is of a general block diagram of a audio and/or video recording and reading device according to the invention;

FIGS. 2A and 2B show schematically the interventions of the user to manage the content of the recording medium of the device of FIG. 1.

The device of the invention can be incorporated in a television decoder or in a television receiver. As shown in FIG. 1, the device of the invention includes means of frequency selection 1 able to provide signals from one or more channels in parallel, the channels being picked up by an antenna 2 in the case of an air or satellite broadcast or received via a cable network. Said means of frequency selection 1 can include one or more analog and/or digital "tuners", in order to provide several channels of programs in parallel. The signals output by said means of frequency selection 1 are processed by means of digital encoding 3 which convert, if need be, the analog signals into digital signals and possibly assure the digital compression and/or multiplexing of the received signals. The encoded digital signals are then fed to the means of recording and reading 4 to be recorded on a large-capacity recording medium 4a. Means of control 5 along with a user interface module 6 (in the form of buttons integrated in the device or a remote controller) enable the user to control the means of frequency selection 1 and the means of recording and reading 4.

As indicated previously, the means of recording and reading 4 can use the matrix-head magnetic recording technique or the techniques of digital video cassettes (in which case the means of digital encoding 3 also assure the multiplexing if two or more channels are to be recorded in parallel on the recording medium 4a).

The means of control 5 enable the creation of an index of the recorded programs on the recording medium 4a to be created, along with one or more menus of the recorded programs. Using a display screen 7, the user can consult the menu(s) of the recorded programs and interact with the means of control 5 via the user interface module 6. Means of decoding 8 are included to enable the decoding of programs broadcast and recorded on the recording medium 4a in encoded form, the decoding command being sent by the means of control 5. The reading signals are processed digitally by means of digital decoding 9 that perform the decompression and/or demultiplexing in order to reproduce the separate programs in parallel. The signals from the means of digital decoding 9 can be digital or converted into analog by means of a digital-to-analog converter 10 in order to reproduction the corresponding program(s) using appropriate devices (television receivers, hi-fi sets, etc.).

The means of control 5 provide the "fast forward", "fast rewind", "pause", "stop", "fast read", etc. functions during reading of a recorded program. The recording medium 4a is advantageously in the form of cassette that is removable from the means of recording and reading 4. It is also possible to manage several cassettes as the recording medium 4a in the means of recording and reading 4 in order to further increase the storage capacity of the device.

The means of control 5 can include an access control unit by which the authorization of reading of certain of the recorded programs is given only if one or more access codes entered by the user via the user interface module 6 are correct. The display screen 7 can be the screen of a television to which is connected or in which is incorporated the

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recording and reading device. We could also make the recording and reading device with the screen 7 built-in. In this case, the screen 7 could be of touch-sensitive type so that the user can interact with the means of control 5 by pressing on the screen (the user interface module 6 being in this case combined with the display screen 7). The touch-sensitive screen 7 can be of liquid crystal type.

The device can include a payment management module 11 linked to a smartcard reader 12, a modem 13 and the means of control 5. When the user wishes to watch a coded program, he inputs a specific code which is stored, for example, on his bank card read by the smartcard reader 12. The payment management module 11 then calls the server center (not shown in the figure) via the modem 13 in order to validate this financial transaction. The payment management module 11 informs the means of control 5 of this validation so that it can start the decoding of the program by the means 8. The user can then watch the corresponding decoded program.

In the example shown in FIGS. 2A and 2B, a menu of the recorded programs is displayed on the display screen 7. It is obviously possible to have several menus of the recorded programs, for example organized by themes (sport, politics, movies, drama, etc.) or by type (for the movies, for example: action, romance, police, etc.). By means of the user interface module 6, the user can select a particular program in the menu.

The means of control 5 then check whether the users private collection includes the selected program (in which case the program is protected by a locking key). If so (the program is already locked), the next screen then displays two options: "erase" and "read". If it is not locked, the next screen includes these two options plus a third, "collection", which enables the user to add this program to his private collection by associating a locking key via the means of control 5.

If the option "erase" is chosen, the next screen requests the user to "confirm" or "cancel" the option (in case "erase" was chosen in error). If the user selected "cancel", the system returns to the program selection screen. If the user opts for "confirm", the device erases the program if it is not locked by a locking key. If it is locked, the user can still delete the program but must first unlock the program via the means of control 5, or he can decide not to erase the program after all. The system then returns to the initial menu.

If the "collection" option is chosen, the next screen proposes two further options: "confirm" and "cancel". When the user confirms the "collection" option, the means of control 5 assign a locking key to the program in order to prevent its direct erasure. The system then returns to the initial menu. If the option "cancel" is chosen, the system simply returns to the initial menu.

If the "read" option is chosen (FIG. 2B), the next screen also proposes two options: "cancel" and "confirm". If the user chooses "cancel", the system returns to the initial menu. If the user chooses "confirm", the means of control 5 check whether direct reading of the selected program is authorized. If so, the program is then read; otherwise the user must enter a correct access code before the reading can start. In the event that the access code is not accepted, the system returns to the screen proposing the sub-options "confirm" and "cancel" of the "read" option. If the program is encoded, the user will notice this and enter a special code (for example, using a bank card) which, after verification, will enable the decoding of the program. If the specific code is not accepted, the system returns to the screen proposing the sub-options

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"confirm" and "cancel" of the "read" option. If the user stops the reading process via the user interface module 6, the system returns to the initial menu.

Among the possible applications of the invention, we can mention the constitution of a personal video and/or audio library providing the user with an authentic on-demand video and/or audio system made up of the recorded programs.

For the video library application with the use of matrix-head magnetic recording technology (which enables several tens of movies to be recorded on an 8 mm cassette), we could envisage for example the following service with a video reservoir containing up to 50 movies: on the first day of use, the 50 movies known to be the most popular (the "Top 50") are broadcast (using 4 parallel channels or a satellite transponder) and stored in the recording and reading device of the invention. The recorded movies are in encoded form to enable the broadcaster to control the mode of payment for viewing the movies (payment per film, per day, etc.). In other words, the movies are stored at the consumer's home but not yet paid for to be viewed in decoded form. The user can then view immediately any movie among the 50 recorded once he has paid the decoding fee.

He can view the film using the functions such as fast forward, fast rewind, pause, stop, and so on, as with a VCR. The user can build a personal collection of movies in the video reservoir by protecting them using a locking key. Each time a movie is broadcast, one of the 50 movies stored in the video reservoir, excluding the personal collection, will be erased and the new one uses the space liberated. In this way the service provider regularly updates the Top 50 movies and sends an updated list weekly or monthly to the subscribers.

The service proposed can also broadcast other movies (1,000 movies, for example, representing 20 days of broadcasting over 4 channels or a transponder) in order to enable users to build their own video libraries taking into account their personal preferences. For example, a user's video reservoir may comprise the "Top 20" movies, regularly updated, plus a personal collection of 10 of his favorite movies for each of three different themes (adventure, science-fiction, drama).

Another application of the invention would be to enable a user to build an audio library from his audio reservoir. An electronic downloading service for music can be provided via a transponder (24 Mbits/s), for example, capable of transmitting the content of a compact disk (150 Mbytes) in 50 seconds. This means that the transponder is capable of delivering the musical equivalent of more than 1,700 compact disks per day. With a storage capacity of 60 gigabytes, the audio reservoir could hold the equivalent of 400 compact disks at all times. The updating of the content of the reservoir can be controlled by the user.

What is claimed is:

1. Method of recording and reading audio and/or video information broadcast as individual programs via one or several channels by air broadcasting, by satellite or by cable TV, comprising the following steps:

- selecting at least one channel to simultaneously provide one or more received signals;
- digitally encoding the received signals;
- compressing and/or multiplexing the encoded digital signals;
- recording the compressed and/or multiplexed digital signals on a large-capacity recording medium;
- creating an index on the recording medium for each individual program recorded;

creating at least one menu of recorded programs;
 selecting one or several programs from a menu of
 recorded programs displayed on a screen;
 reading said signals indicative of said selected program
 (s);
 decompressing and/or demultiplexing the signals read;
 decoding the signals decompressed and/or demultiplexed;
 reproducing the corresponding audio and/or video infor-
 mation; and

wherein said recording on and reading from said large
 capacity recording medium are independent of each
 other, in order to enable reading of a recorded program
 while simultaneously recording a plurality of other
 programs, said other programs not always being
 recorded in continuous form on said large capacity
 recording medium, without erasing said recorded pro-
 gram being read.

2. Method according to claim 1, further comprising
 assigning a locking key to prevent the direct erasure of
 certain of the recorded programs.

3. Method according to claim 1, consisting in recording
 and reading video programs (television programs or movies)
 and/or audio programs (music, news, conferences, etc. . .).

4. Method according to claim 1, wherein several programs
 are recorded in parallel and simultaneously on said record-
 ing medium.

5. Method according to claim 1, wherein several programs
 are reproduced simultaneously.

6. Recording and reading device recording and reading
 audio and/or video information broadcast as individual
 programs via one or several channels by air broadcasting, by
 satellite or by cable TV, including:

means of reception frequency selection enabling recep-
 tion of one or more broadcasting channels simulta-
 neously;

means of digital encoding of the received signals;

means of recording and reading said encoded digital
 signals, including a large-capacity recording medium in
 the form of at least one magnetic tape with N longitu-
 dinal parallel tracks ($N > 2$), a magnetic recording head
 composed of $N \times M$ recording elements ($M \geq 1$), and a
 magneto-optic read head capable of reading the N
 tracks simultaneously;

means of control enabling the recording and reading of
 programs to be controlled independently;

means of processing the reading signals in order to
 reproduce the sound and/or image; and wherein:

said recording on and reading from said large-capacity
 recording medium by said means for recording and
 reading are performed independently of each other in
 order to enable reading of a recorded program while
 simultaneously recording a plurality of other
 programs, said other programs not always being
 recorded in continuous form on said large-capacity
 recording medium, without erasing said recorded
 program being read.

7. Device according to claim 6, including means of access
 control (5) to enable reading of at least some of said
 recorded programs after identification of an access code.

8. Device according to claim 6, including means (8) of
 decrypting of certain of said recorded programs that are in
 encrypted form after identification of a specific code.

9. Device according to claim 7, wherein said means of
 access control (5) generate a locking key, at the request of
 the user, to prevent the direct erasure of certain on the
 recorded programs.

10. Device according to claim 6, including a touch-
 sensitive screen (7) on which one or more menus can be
 displayed, generated by said means of access control (5),
 indicating the titles and possibly the themes of the recorded
 programs, so that the user can select and control said device
 directly by touching said touch-sensitive screen.

11. Device according to claim 6, connected to a television
 receiver whose screen (7) is used to display one or more
 menus generated by said means of access control (5),
 indicating the titles and possibly the themes of the recorded
 programs, so that the user can select and control said device
 directly by using a remote controller (6).

12. Device according to claim 6, wherein said magnetic
 recording tape (4a) can be removed from the device.

13. Device according to claim 6, wherein said means of
 processing (8, 9) the reading signals provide at least two
 programs in parallel that are reproduced independently of
 each other.

14. Television reception decoder, incorporating within its
 case a recording and reading device according to claim 6.

15. Television receiver incorporating a recording and
 reading device according to claim 6.

16. The method according to claim 1, wherein at least
 some of the received signals are encrypted and further
 comprising the step of:

entering a specific code to enable decrypting of said
 signals corresponding to at least one of said programs.

* * * * *



US006934963B1

(12) **United States Patent**
Reynolds et al.

(10) **Patent No.:** **US 6,934,963 B1**
 (45) **Date of Patent:** **Aug. 23, 2005**

(54) **INTERACTIVE TELEVISION PROGRAM GUIDE WITH PASSIVE CONTENT**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/400,391**

(22) Filed: **Sep. 21, 1999**

Related U.S. Application Data

(60) Provisional application No. 60/101,355, filed on Sep. 22, 1998.

(51) Int. Cl.⁷ **H04N 5/445**

(52) U.S. Cl. **725/39; 725/38; 725/40; 725/41; 725/60; 725/61; 725/42; 725/43**

(58) Field of Search **725/60, 61, 37-59**

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Primary Examiner—John Miller

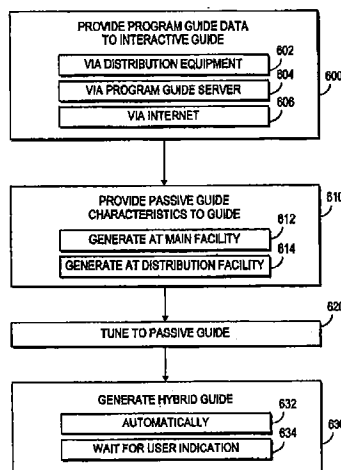
Assistant Examiner—Annan Q Shang

(74) *Attorney, Agent, or Firm*—Fish & Neave IP Group of Ropes & Gray LLP

(57) **ABSTRACT**

A hybrid passive-interactive program guide is generated by combining the features of an interactive program guide with the passive video portion of a passive program guide. The interactive guide may replace passive listings with interactive listings, replace passive features with interactive features, provide supplemental advertisements, or replace passive tagging information with interactive tagging information. Users may be provided with an opportunity to purchase a program or product being advertised, to view listings for segments aired in the video portion of the passive guide, to schedule reminders for listings or video segments that are displayed by the passive guide, or to schedule video segments and related information for recording.

47 Claims, 23 Drawing Sheets



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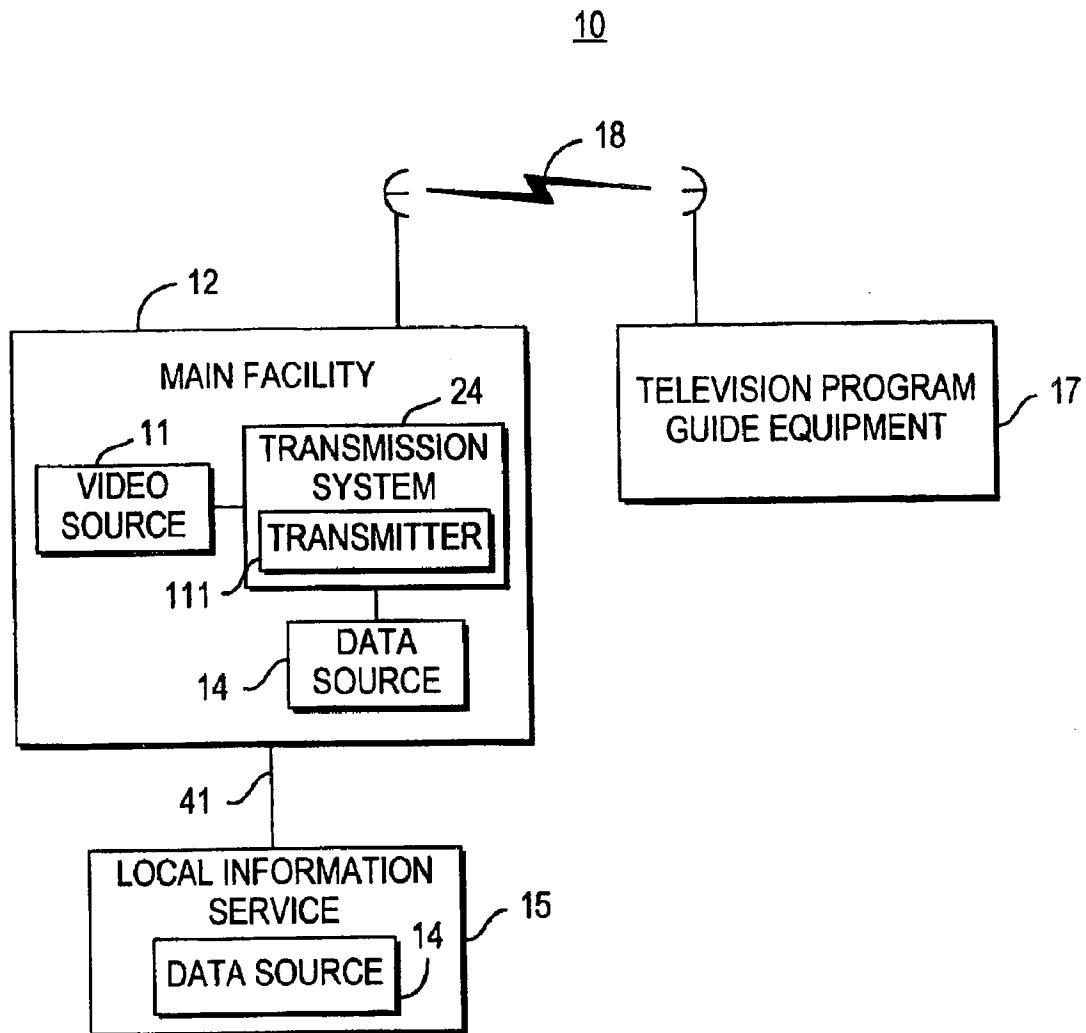


FIG. 1

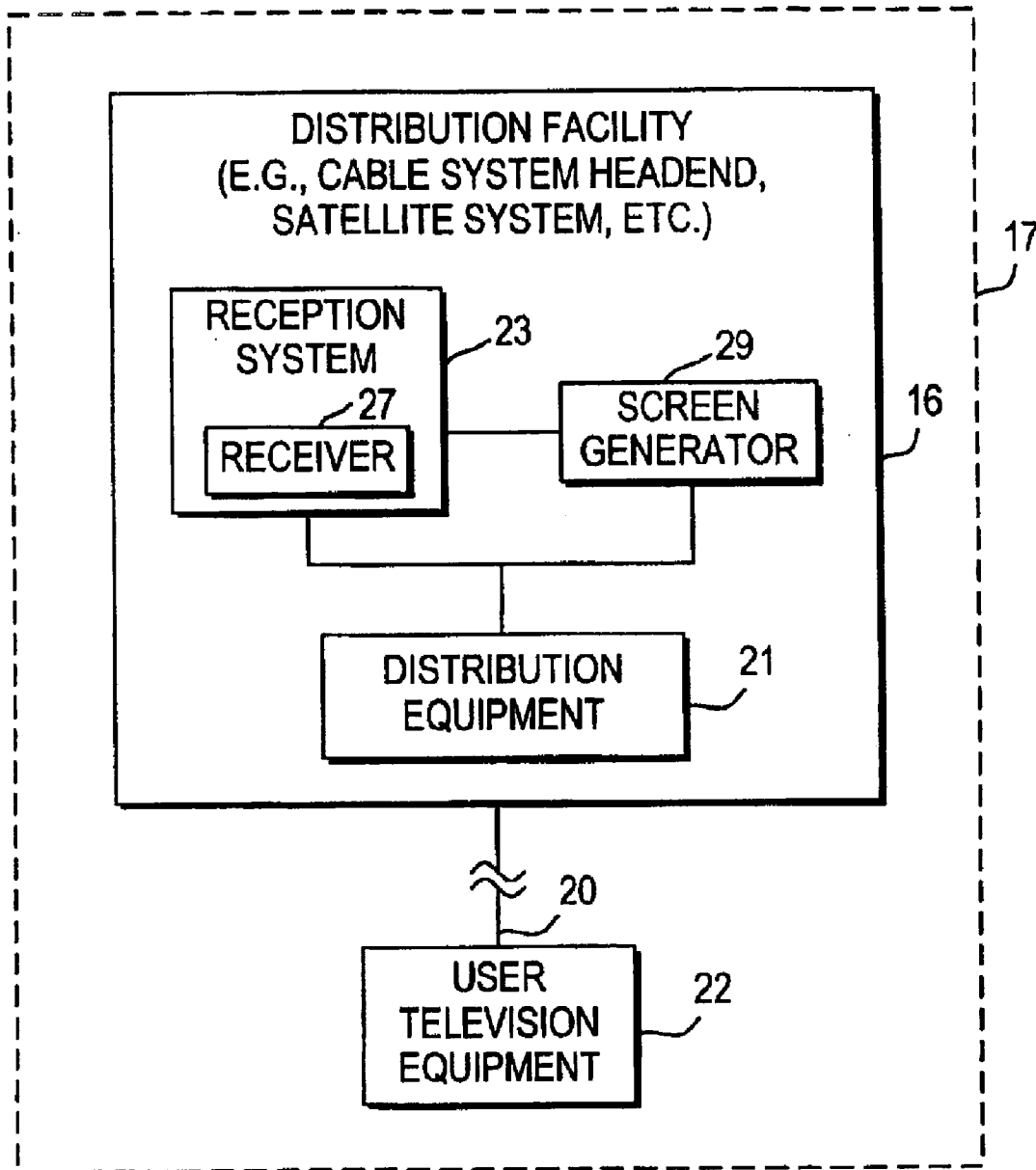


FIG. 2a

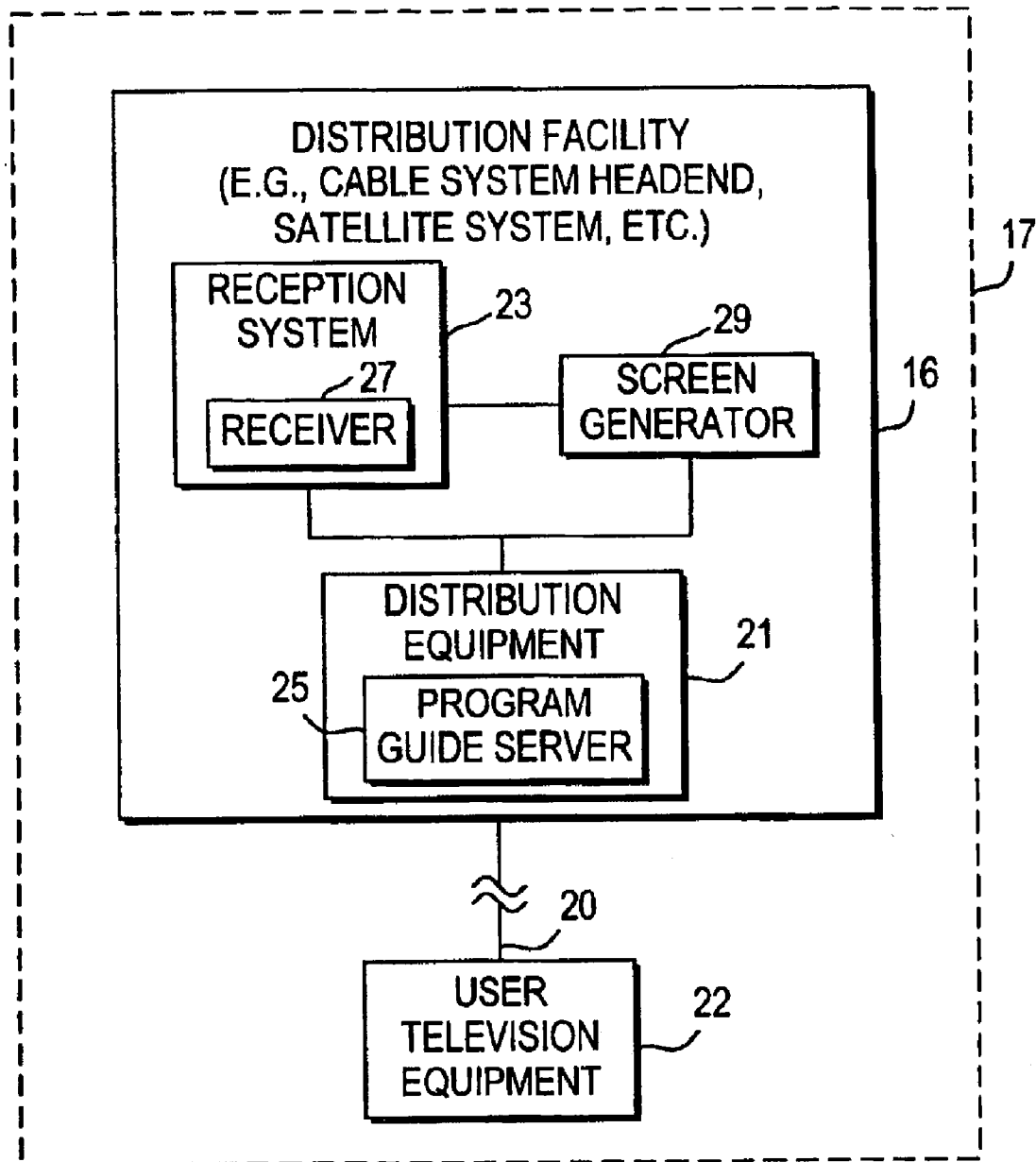


FIG. 2b

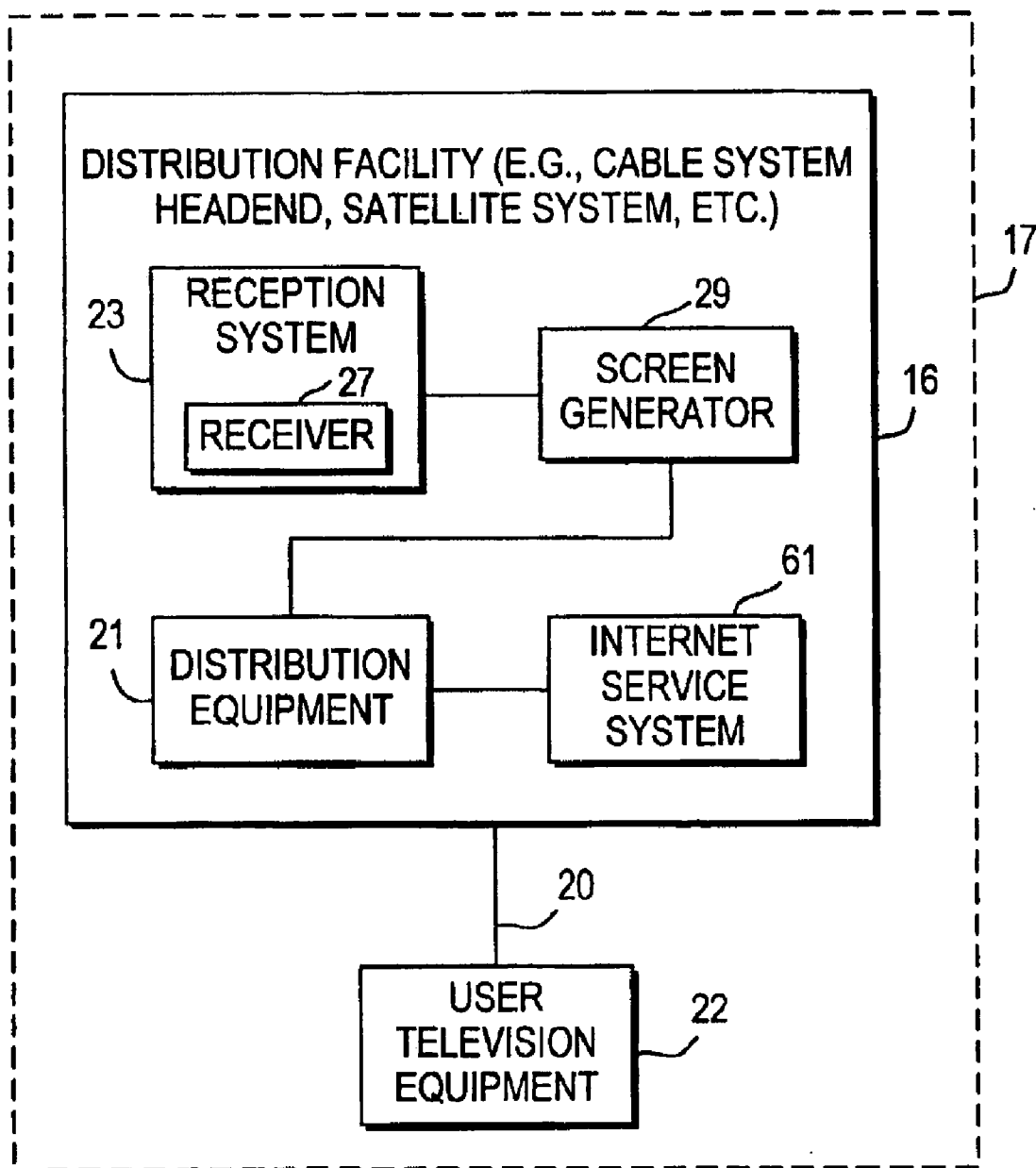


FIG. 2c

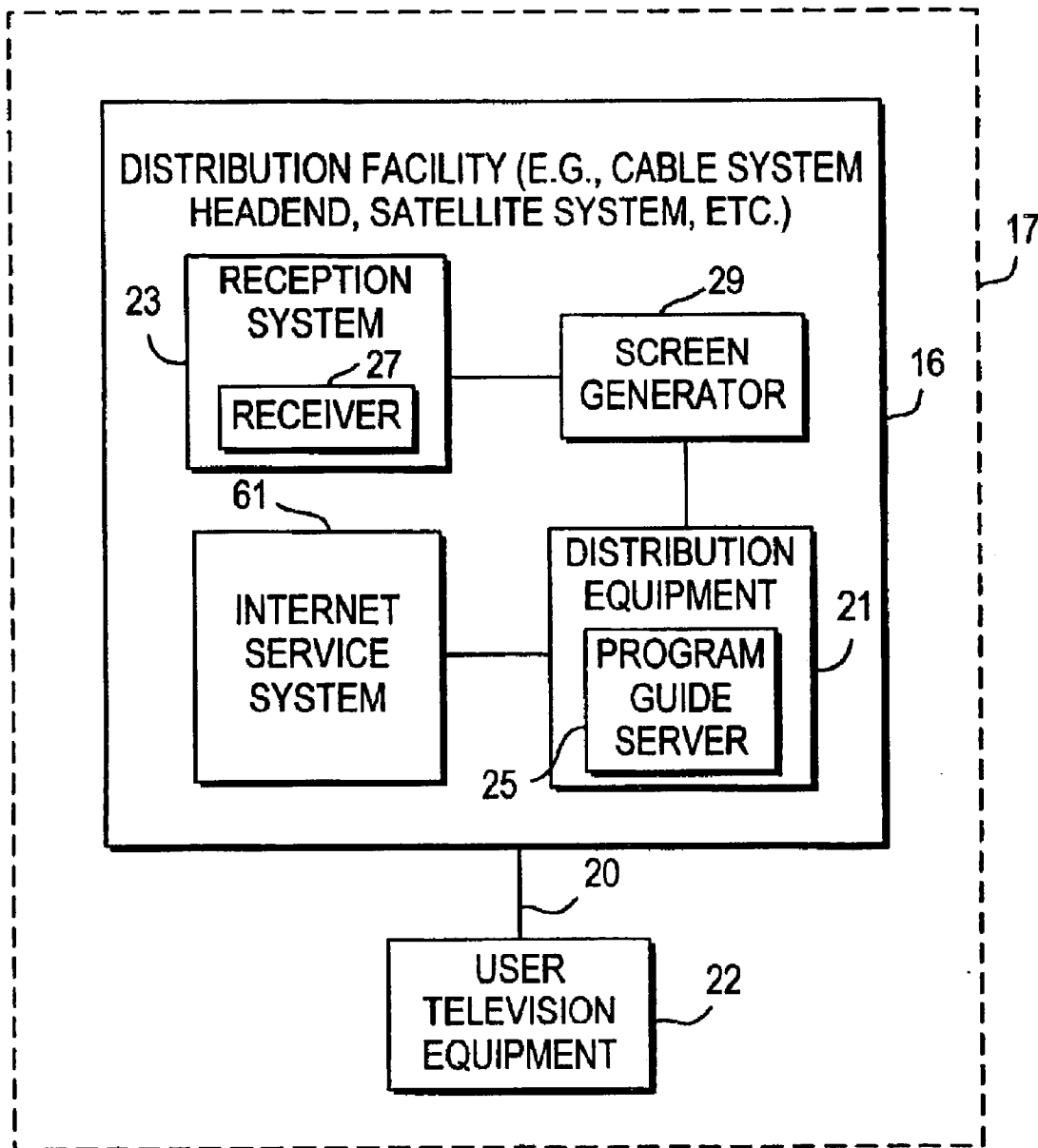


FIG. 2d

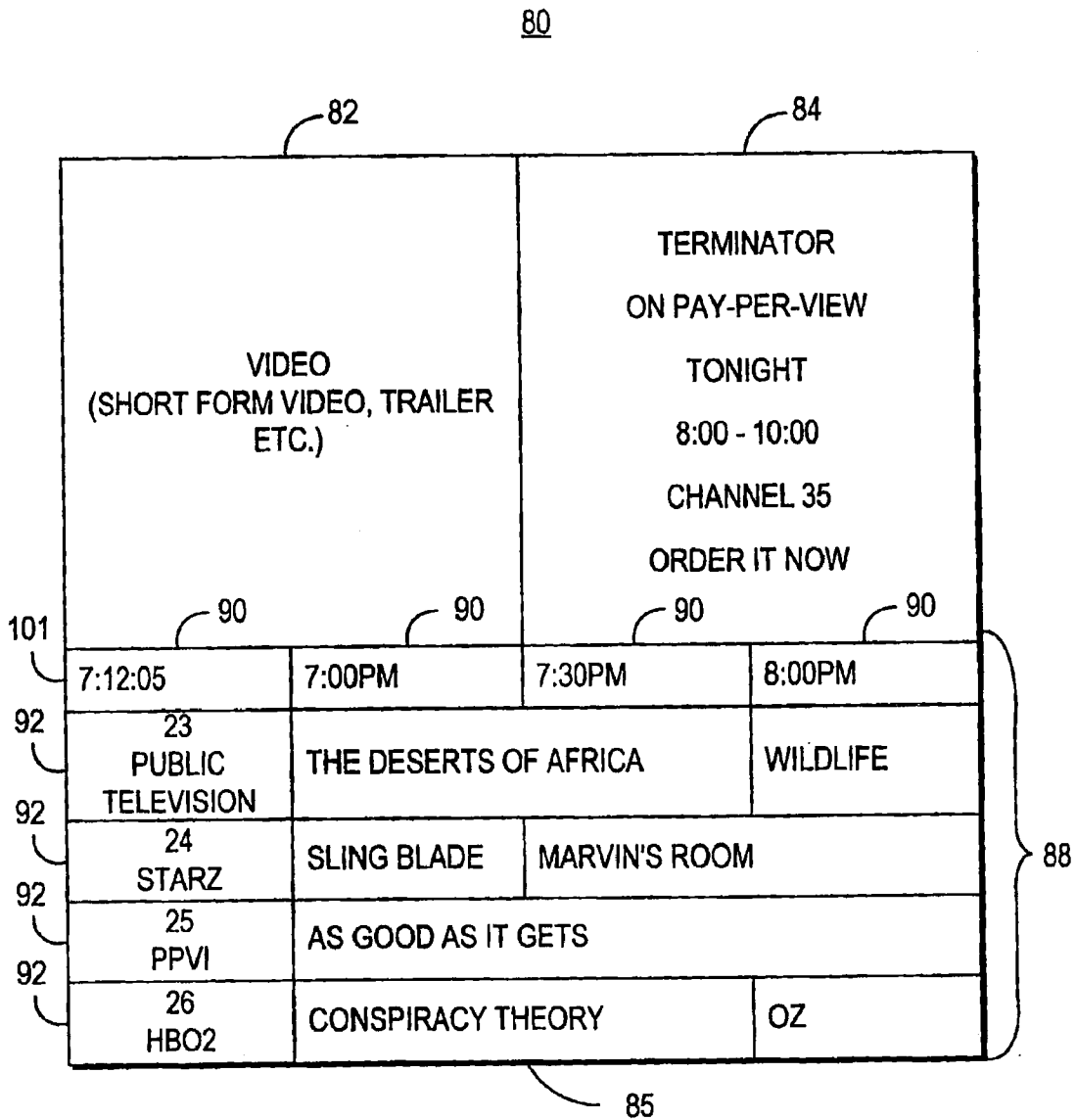


FIG. 3a

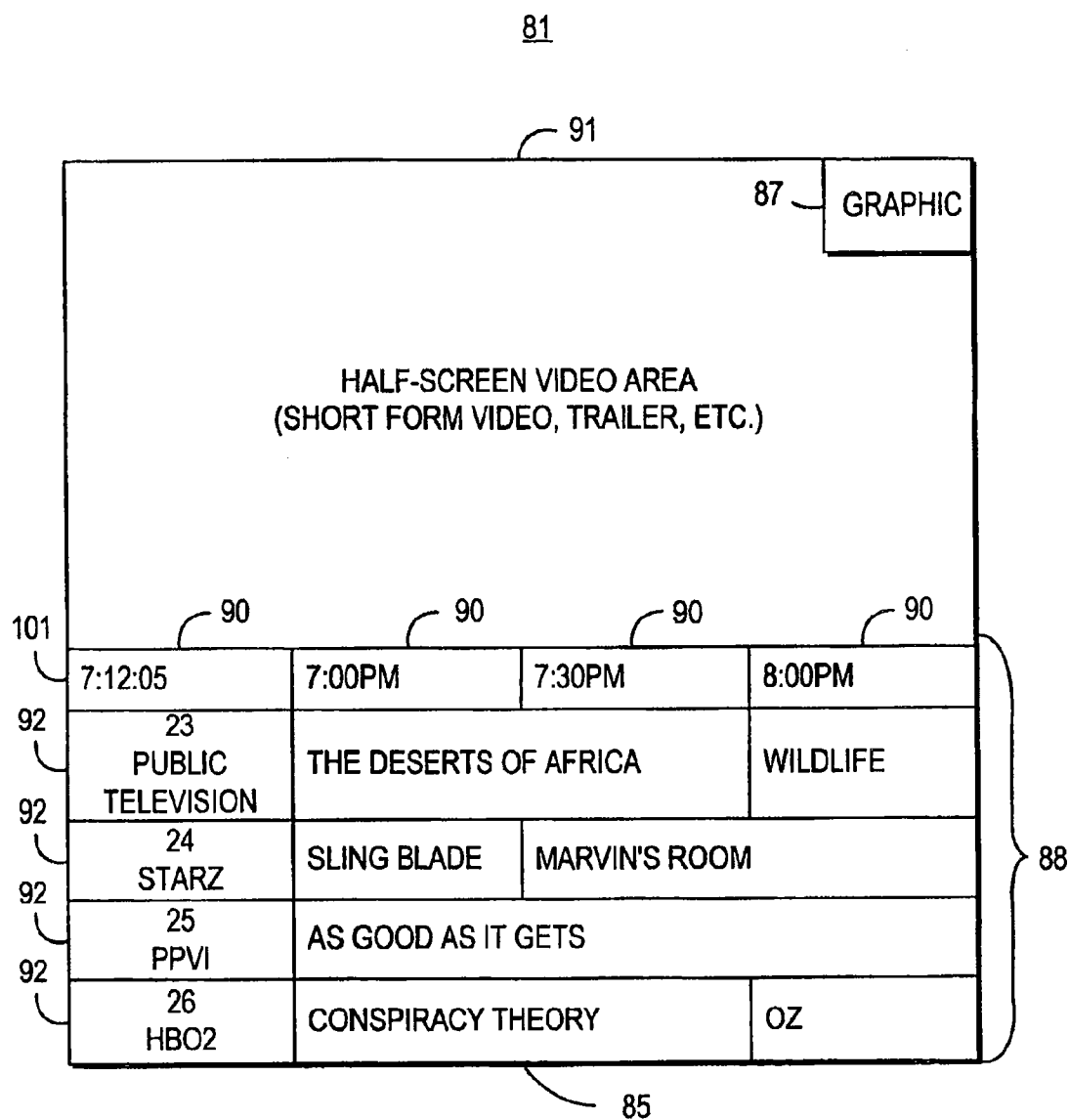


FIG. 3b

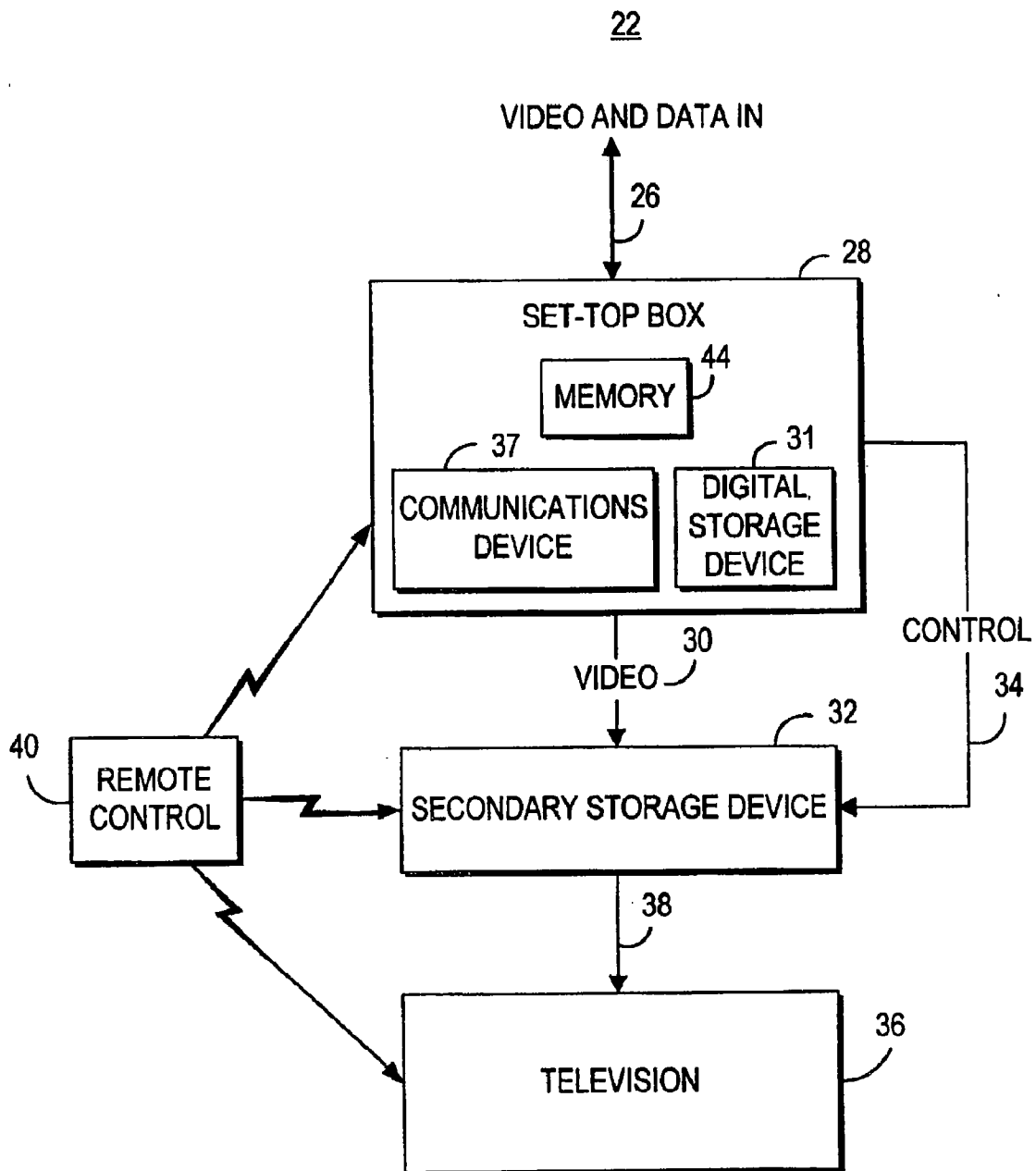


FIG. 4

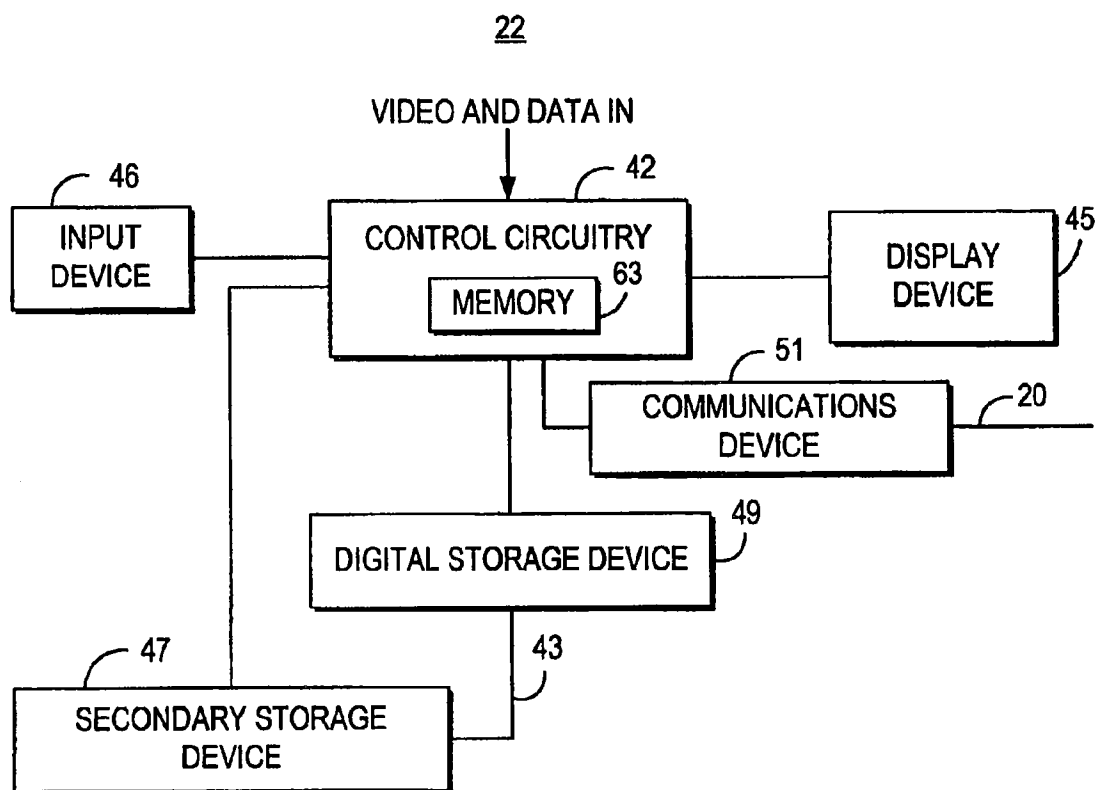


FIG. 5

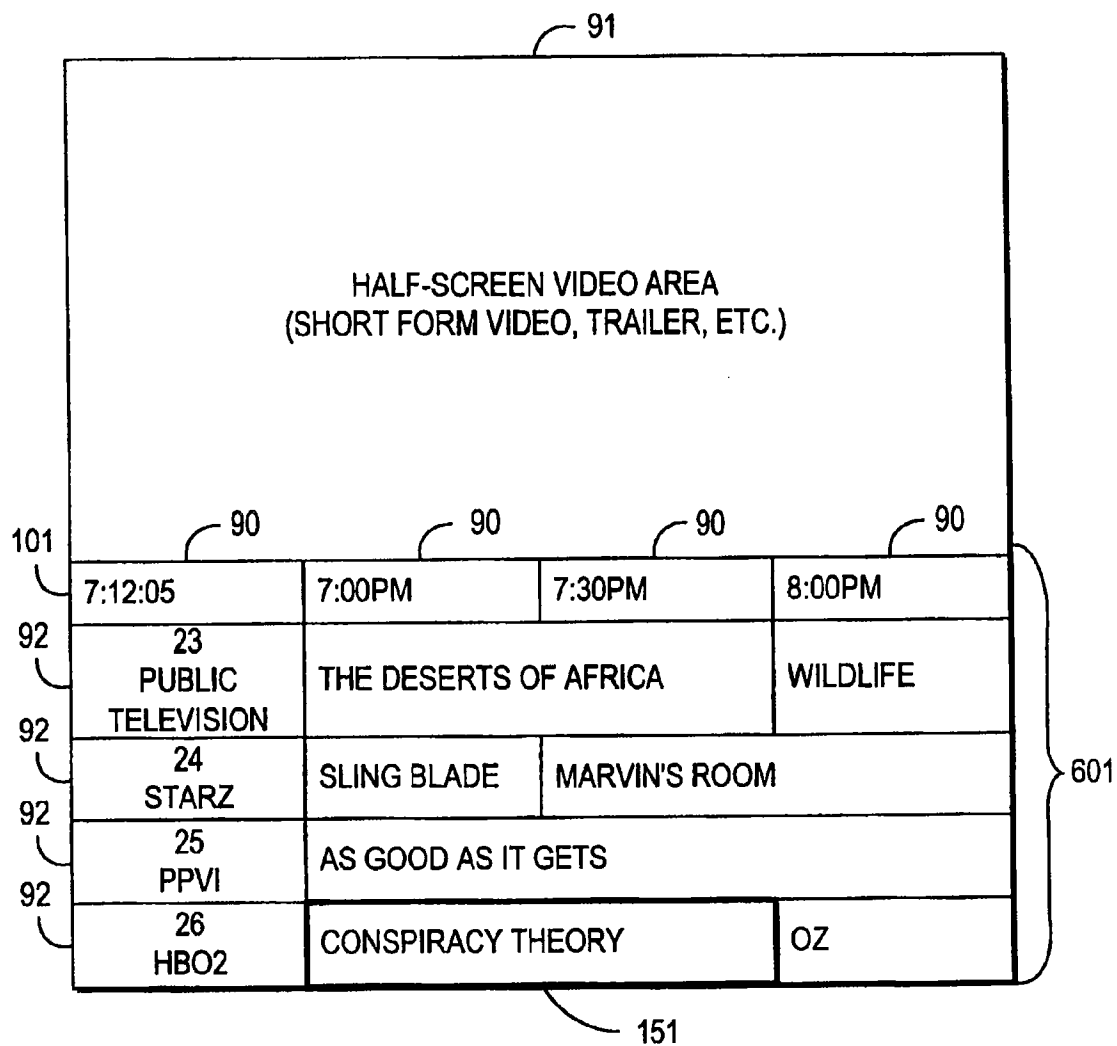


FIG. 6

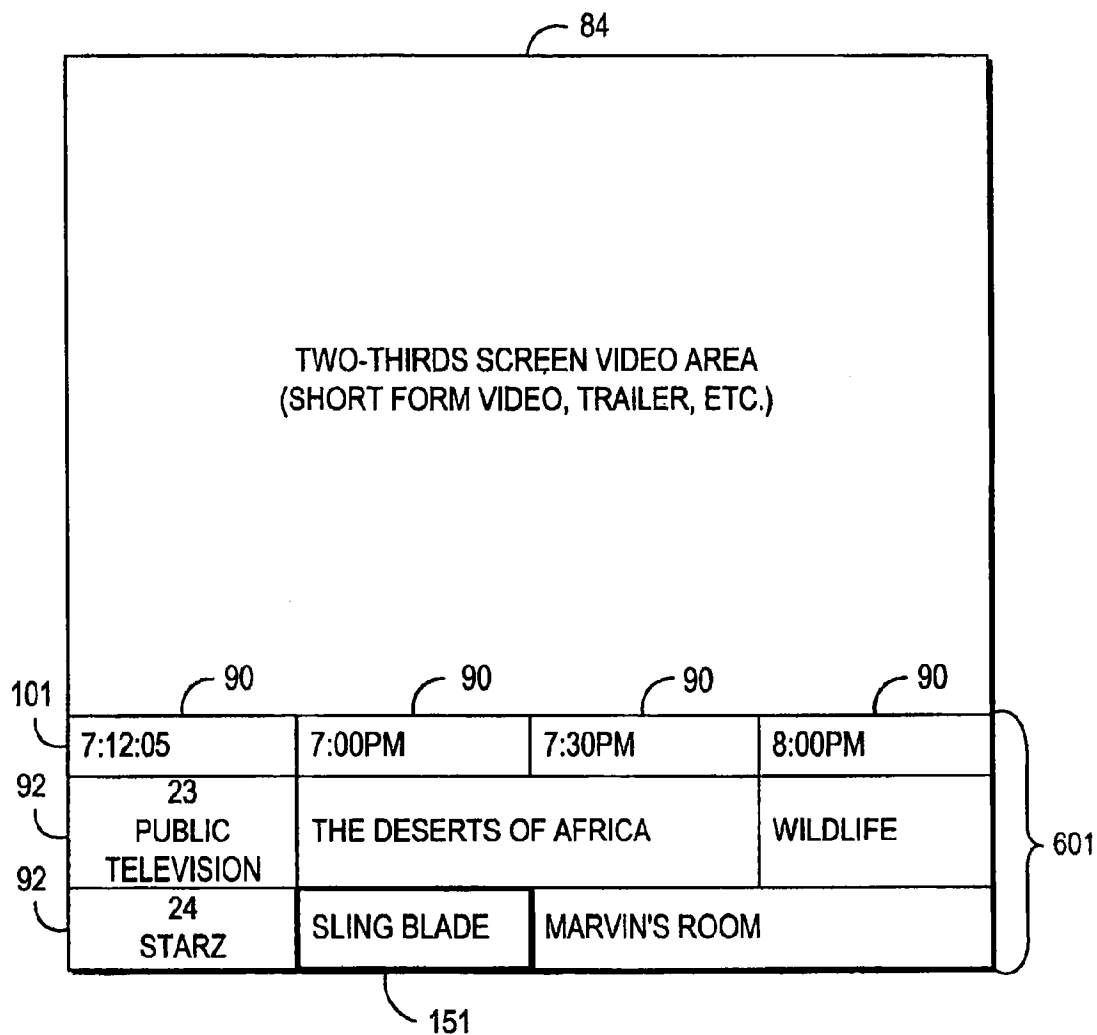


FIG. 7

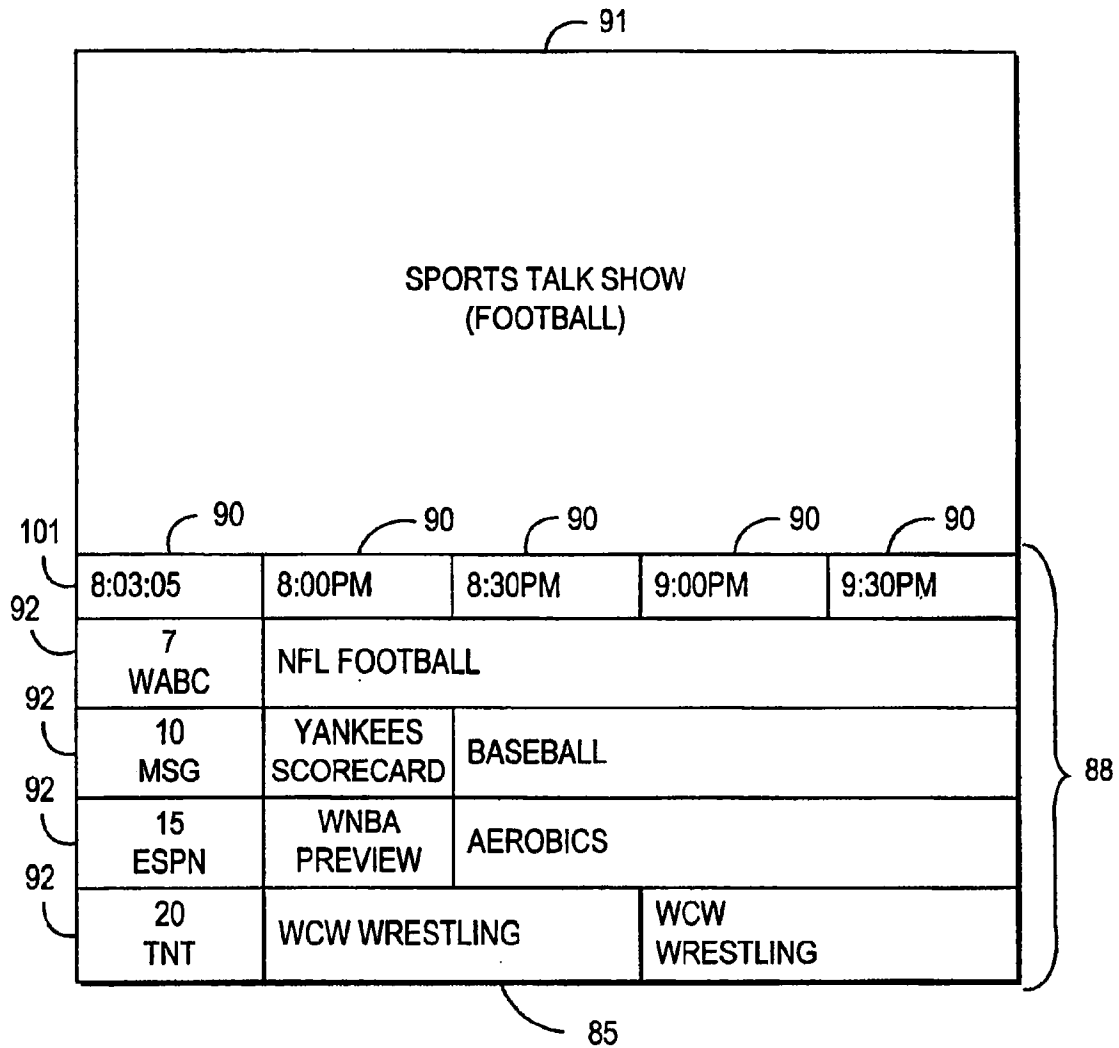


FIG. 8a

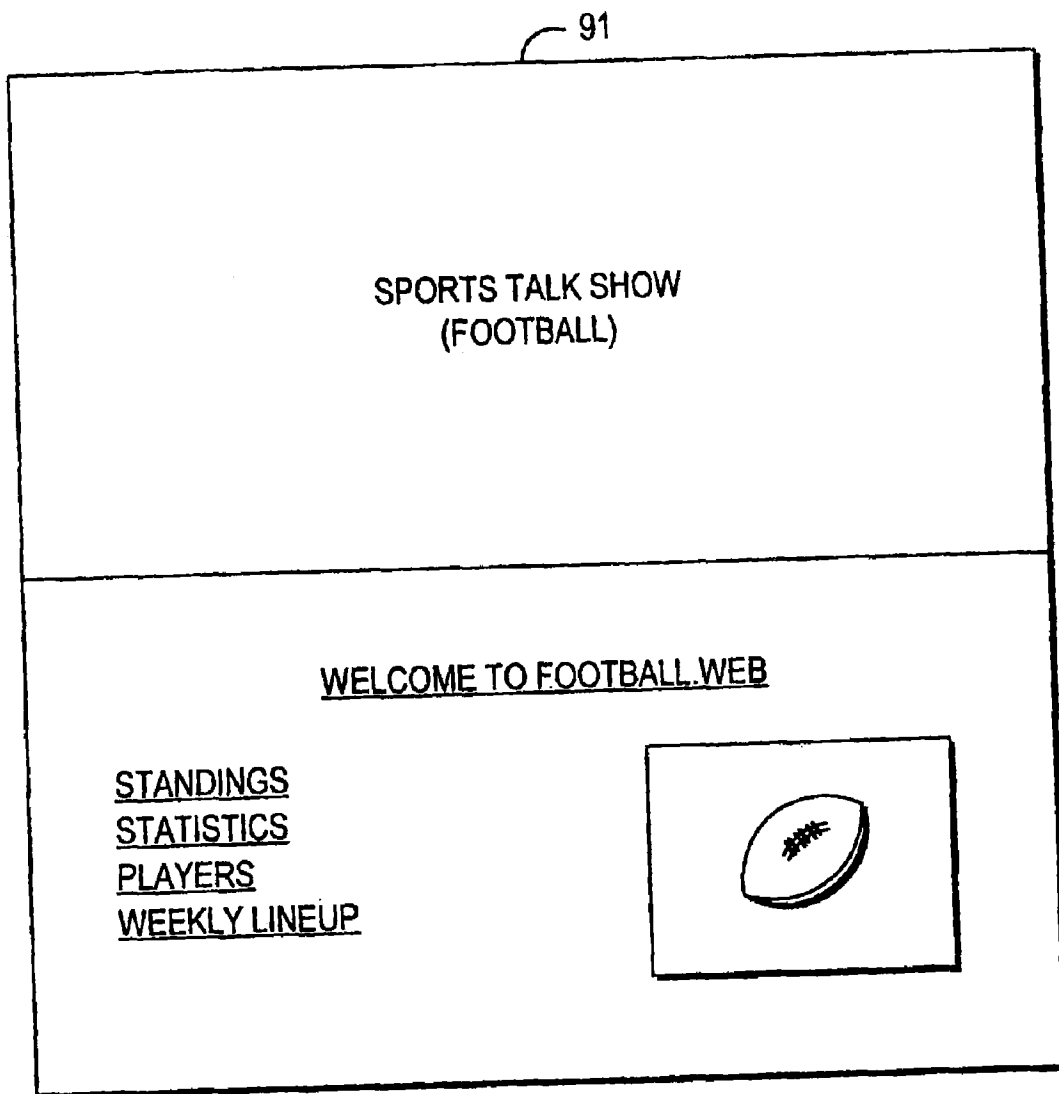


FIG. 8b

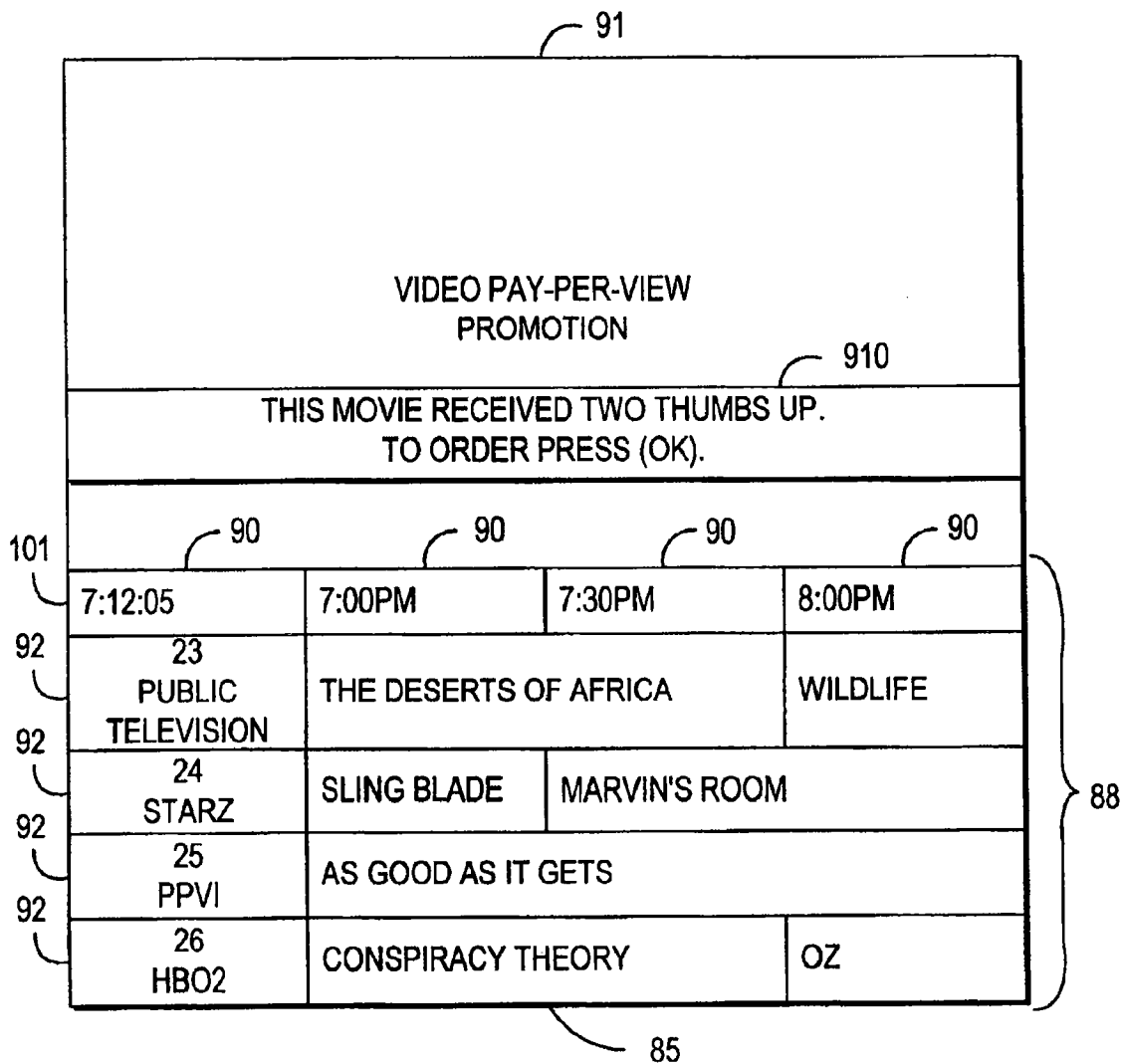


FIG. 9a

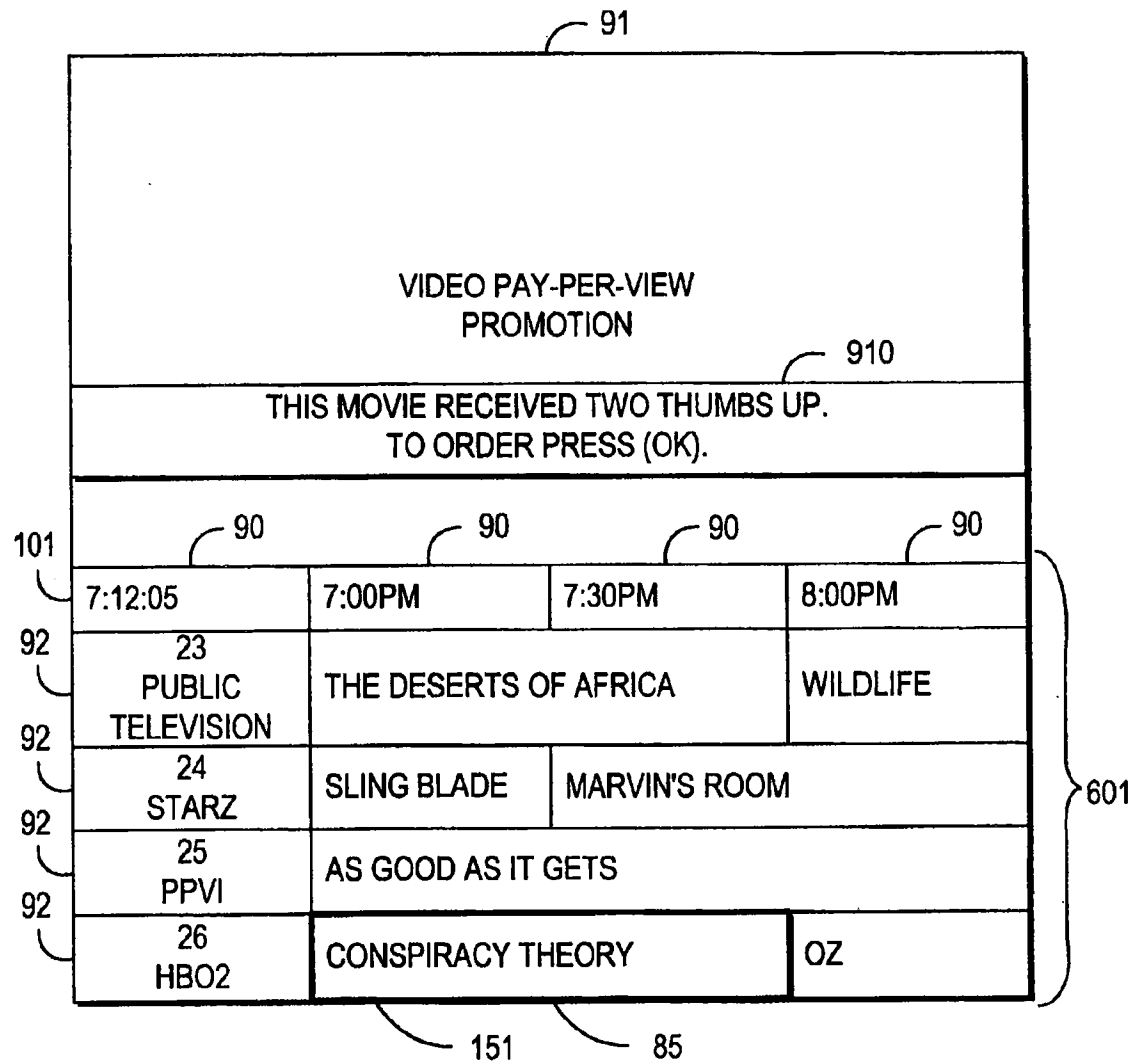


FIG. 9b

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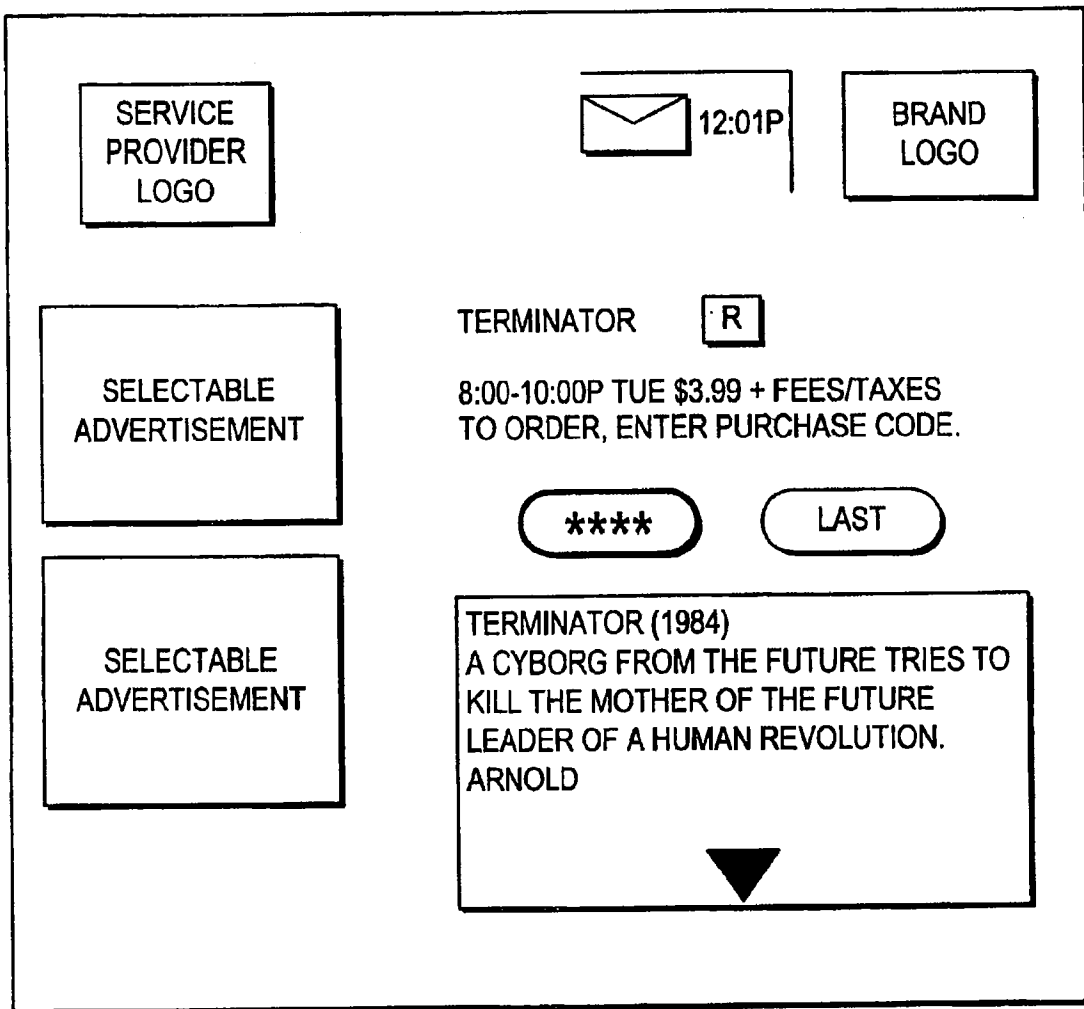


FIG. 10

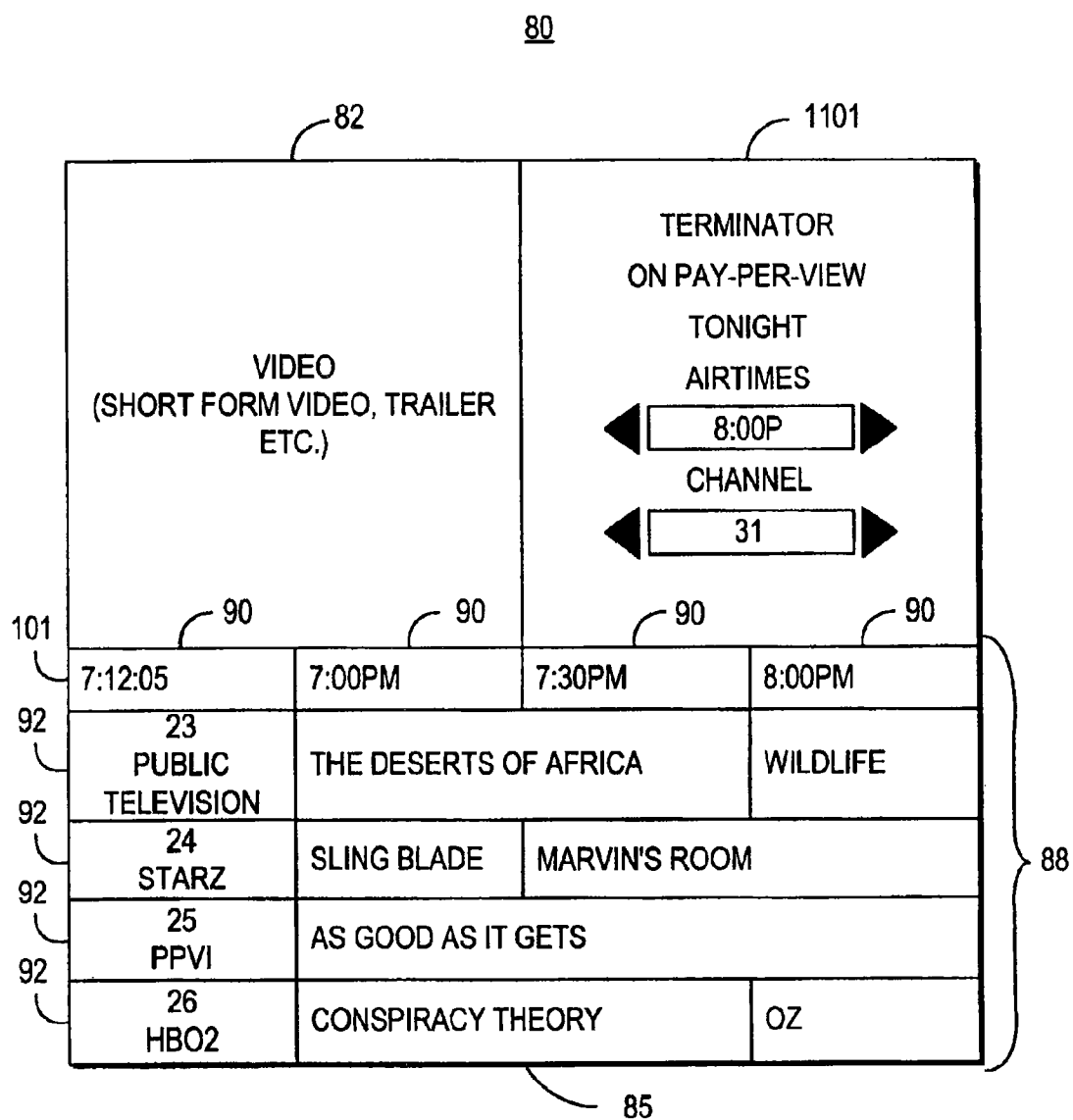


FIG. 11

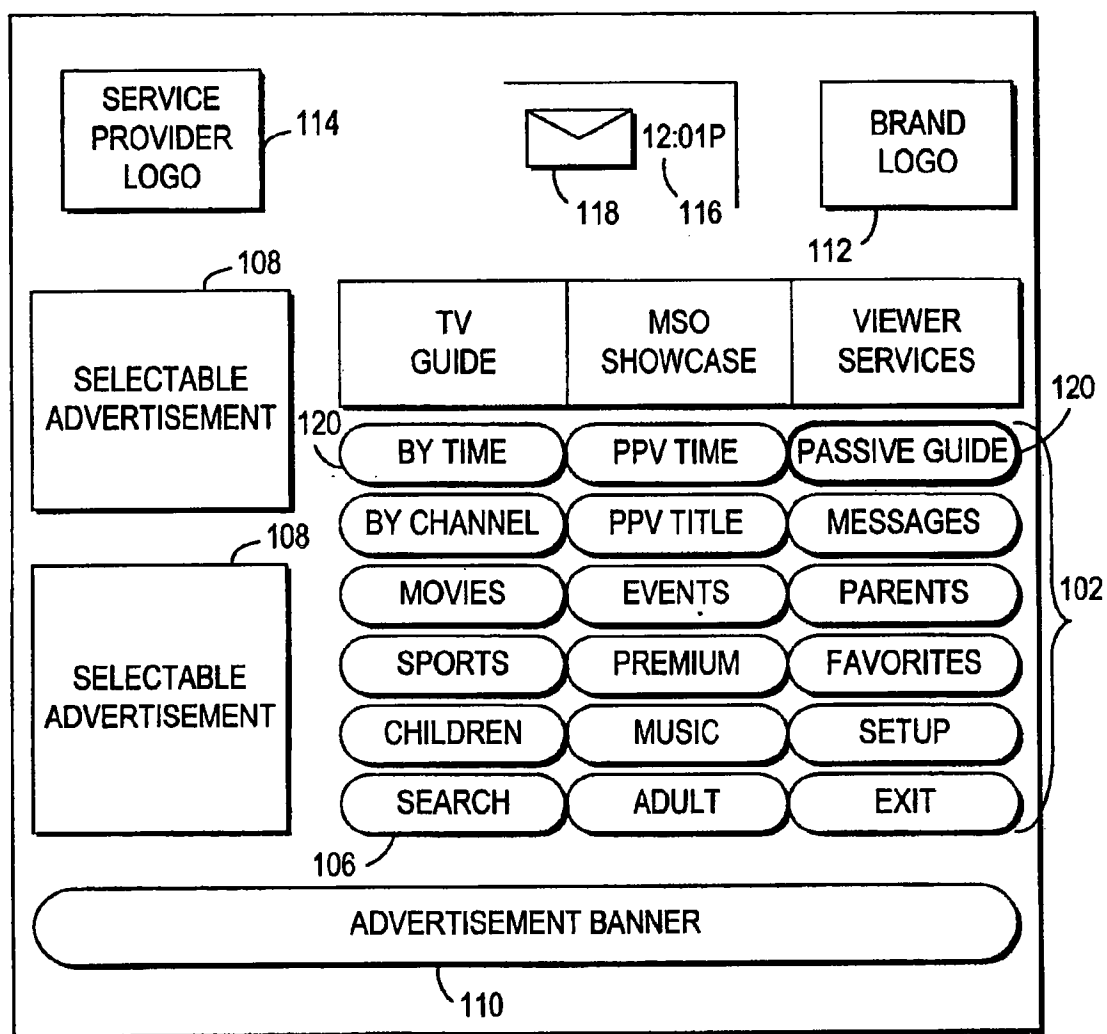
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FIG. 12

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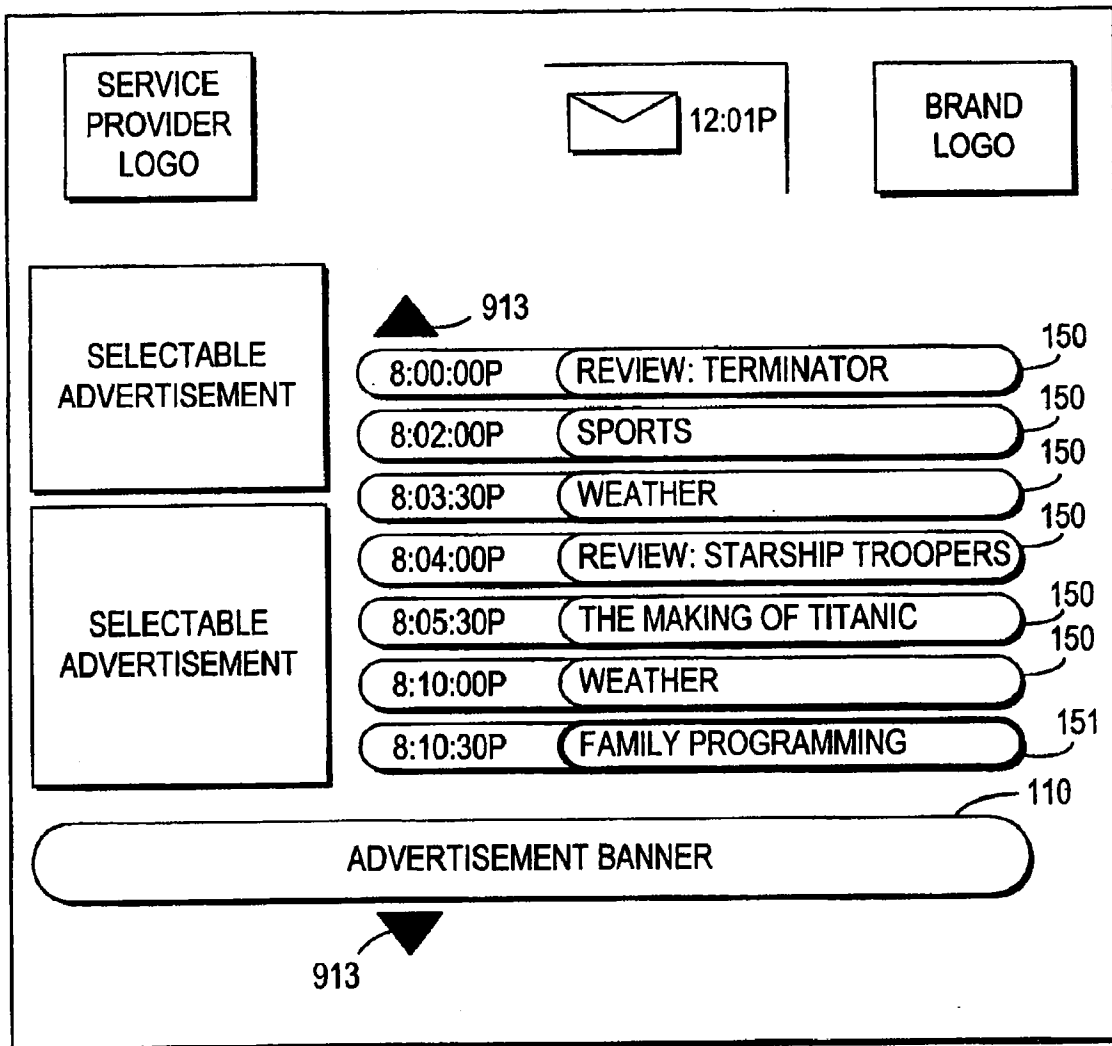


FIG. 13

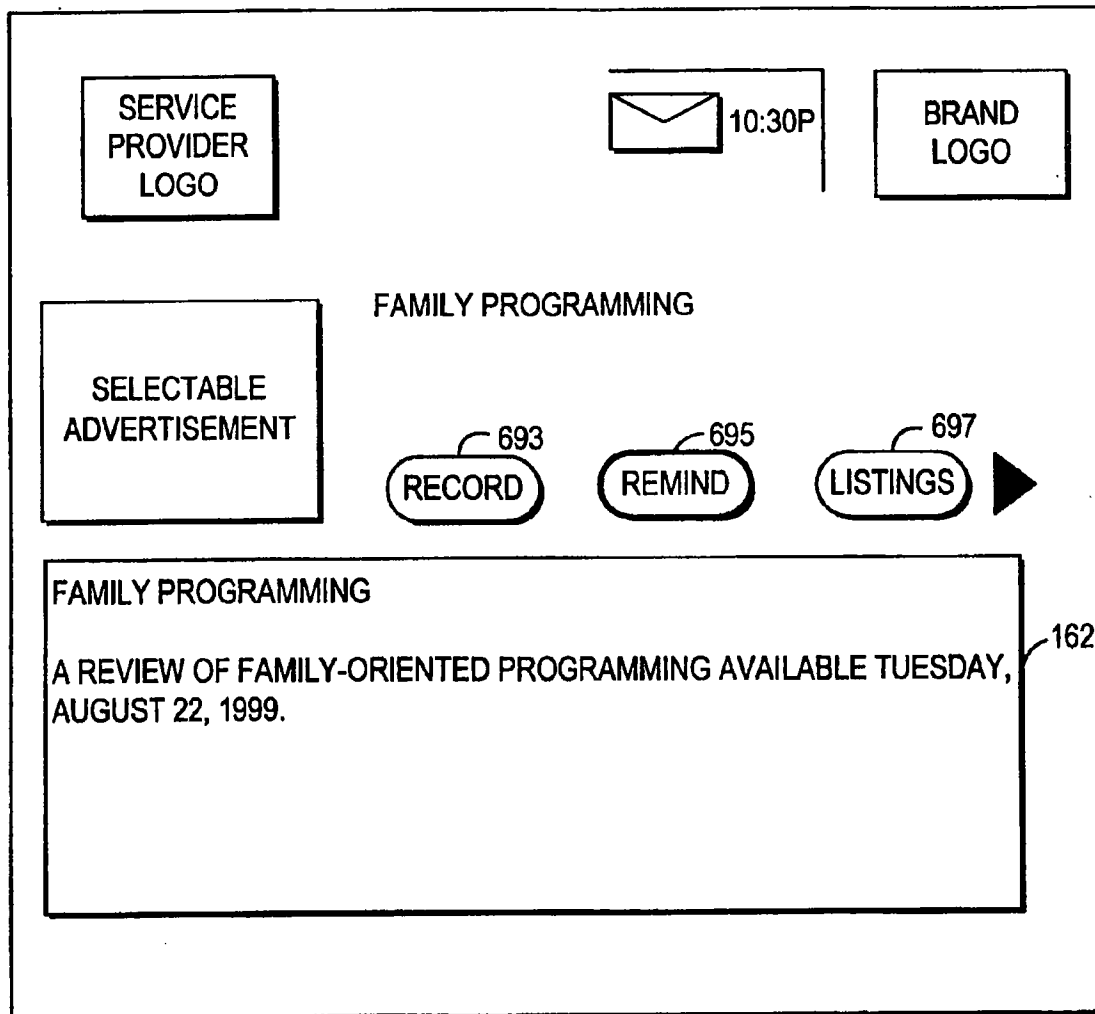
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FIG. 14

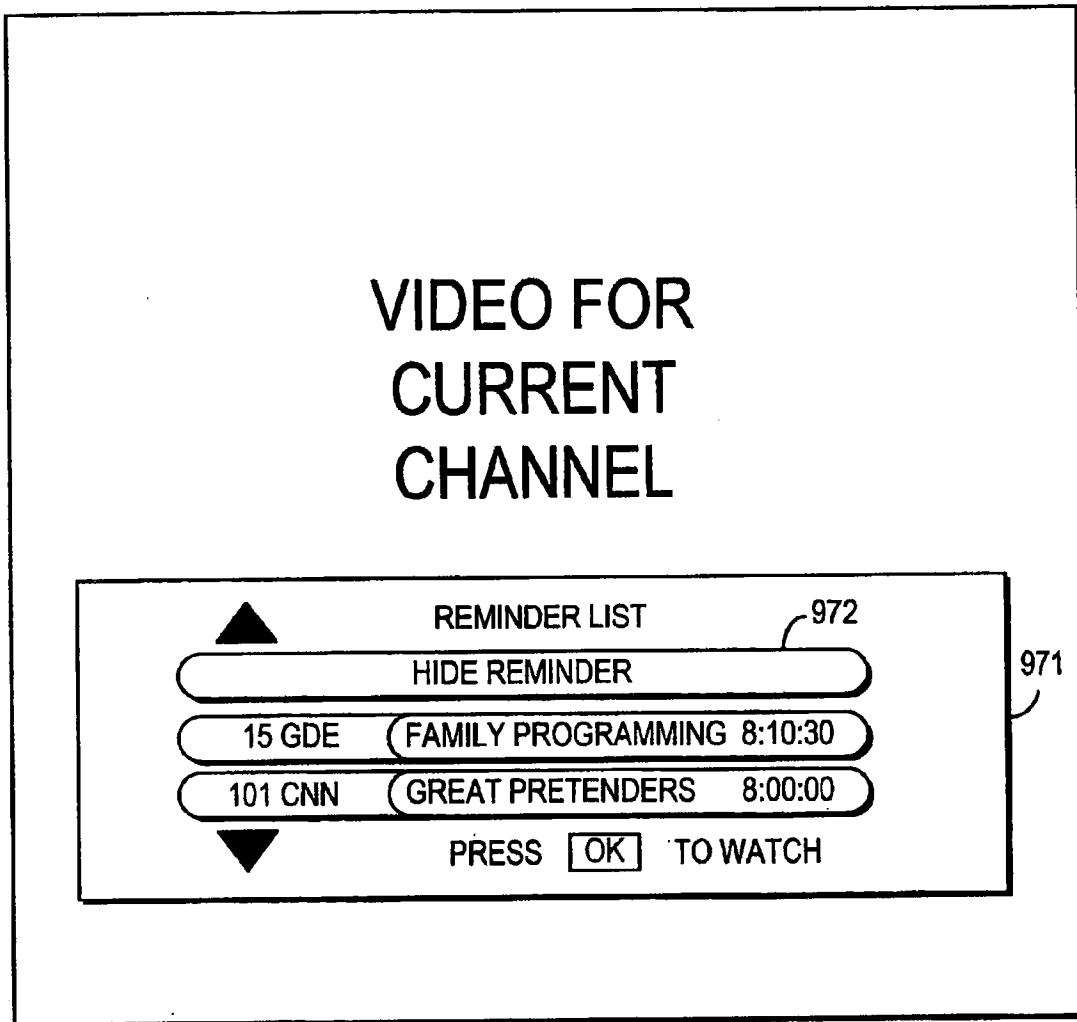


FIG. 15

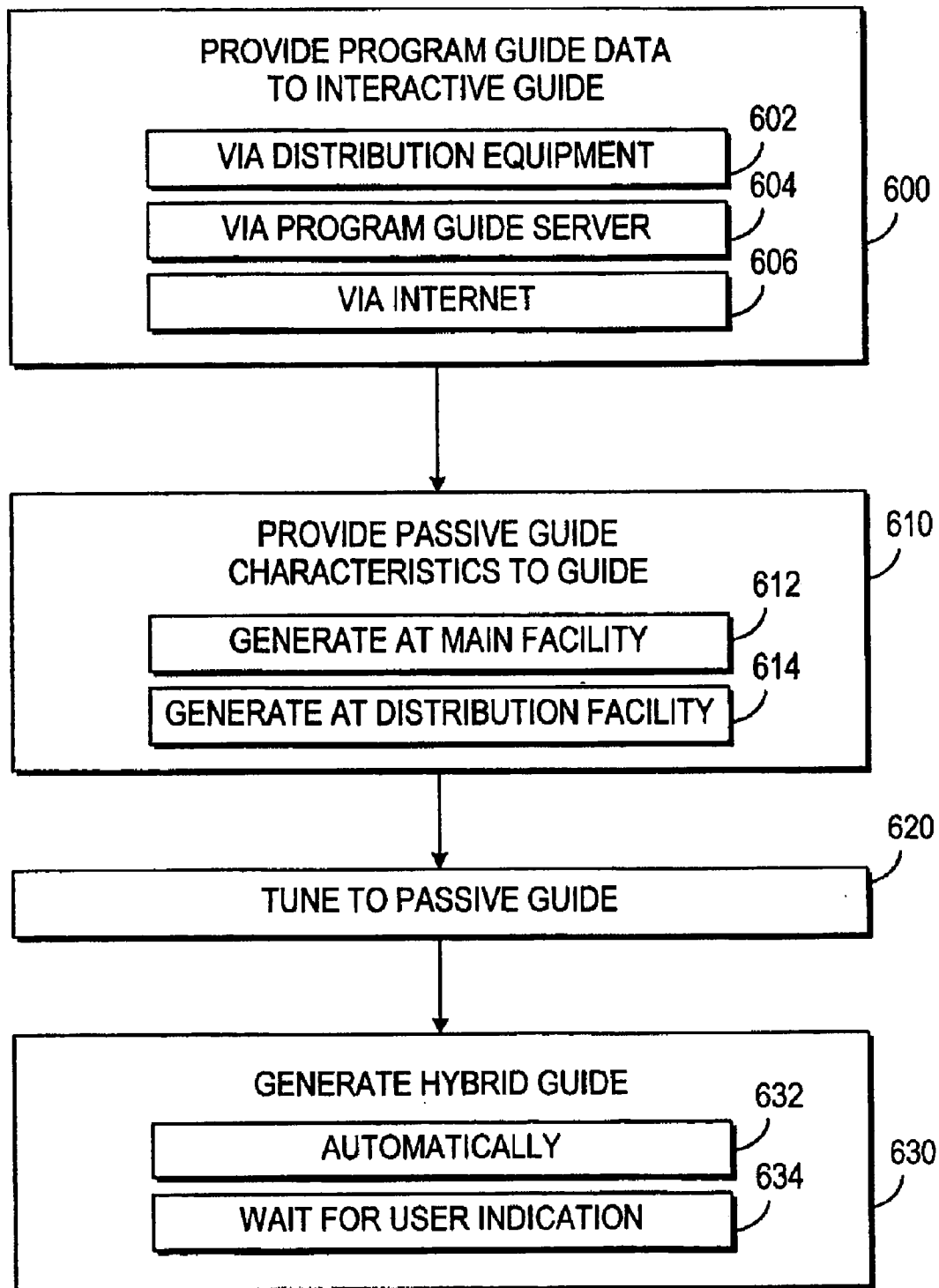


FIG. 16

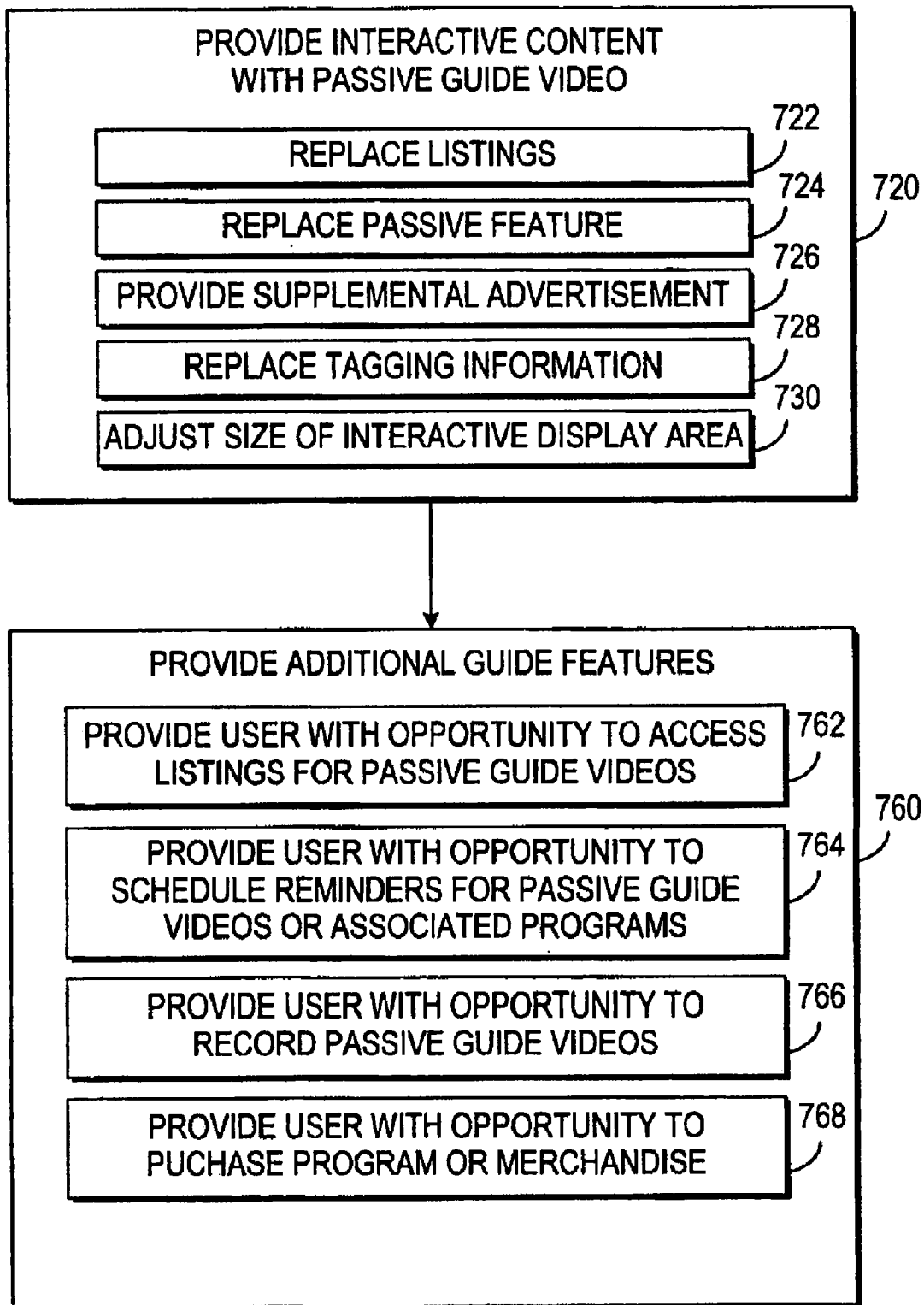


FIG. 17

INTERACTIVE TELEVISION PROGRAM GUIDE WITH PASSIVE CONTENT

This application claims the benefit of U.S. provisional application No. 60/101,355, filed Sep. 22, 1998.

BACKGROUND OF THE INVENTION

This invention relates to electronic television program guide systems, and more particularly, to interactive television program guide systems with passive content.

Cable, satellite, and broadcast television systems provide viewers with a large number of television channels. Users have traditionally consulted printed television program schedules to determine the programs being broadcast at a particular time. More recently, passive television program guides have been developed that allow users to tune to a television channel and view a list of program listings for upcoming programs. Passive guides have been developed that display video promotions in one portion of the screen, while displaying program listings in another.

Passive guides require users to wait until the list of program listings scrolls to display listings for the channel or time that the users are interested in. Users of passive guides have no way of controlling how quickly or how often listings appear, and have no way of immediately viewing listings for particular channels or time slots. In addition, passive guides do not provide users with the ability to schedule programs for recording, to view listings for favorite channels, to parentally control programs, or to perform other desirable functions that require user interaction.

Interactive television program guides have been developed that allow television program information to be displayed on a user's television. Interactive television program guides, which are typically implemented on set-top boxes, allow users to navigate through television program listings using a remote control. In a typical interactive program guide, various groups of television program listings are displayed in a grid or table according to predefined or user-selected categories. With interactive guides, however, there is generally no way to provide centrally-controlled promotional media such as promotional videos to users for display by the program guide while the users are viewing program listings.

Hybrid passive-interactive program guide systems have been proposed in which the video portion of a passive guide channel is combined with interactive listings. Such systems provide some of the benefits of interactive television program guides while maintaining the video capability of passive guides. It would be desirable if a hybrid program guide system could be provided in which the interactive program guide features of the system are coordinated with the passive components of the system in order to improve the display screens provided by the system, and to provide interactive program guide features related to passive guide content.

It is therefore an object of the present invention to provide a hybrid passive-interactive television program guide in which the interactive program guide features are coordinated with the passive program guide components of the system.

SUMMARY OF THE INVENTION

This and other objects of the present invention are accomplished in accordance with the principles of the present invention by providing a hybrid passive-interactive television program guide system in which passive electronic

television program guide content is integrated with an interactive television program guide. Information on the content of the passive electronic television program guide is provided to the interactive television program guide, so that the features on the interactive television program guide may be coordinated with the passive guide content.

In the hybrid guide system of the present invention, a main facility (e.g., a satellite uplink facility) provides data from a data source to a number of distribution facilities (e.g., cable system headends, broadcast distribution facilities, a satellite distribution facilities, or any other suitable distribution facilities). There may be multiple data sources, some of which may be located at different facilities and which provide data to the main facility for localization and distribution. The data transmitted by the main facility to the distribution facilities includes television programming data (e.g., titles, channels, content information, rating information, advertising information or any other information associated with television programming), and may include other data for additional services other than television program listings (e.g., weather information, associated Internet web links, computer software, video clips, non-television advertisements etc.), any suitable combination of which is referred to herein as program guide data.

The main facility may also provide one or more videos to the distribution facilities. The videos may be transmitted in real time by the main facility to the distribution facilities for real-time distribution to the user television equipment of a number of users. Alternatively, the main facility may transmit videos to the distribution facilities where they are stored. The distribution facilities may later distribute the videos to the user television equipment of a number of users in real time. This approach may be referred to as a "store-and-forward" video distribution scheme. If desired, a combination of the two approaches may be used. In still another suitable store-and-forward approach, passive guide videos may be provided on storage media (e.g., laser disks, digital versatile discs (DVDs), etc.), that are provided to the distribution facilities via the mail.

The distribution facilities generate and distribute passive guide display screens containing the television programming data (e.g., program listings), other data, videos, or any suitable combination thereof as a video signal over a dedicated television channel to the television equipment of a number of viewers. In an illustrative passive guide, users are presented with videos such as promotions, trailers and informative segments in one portion of a display screen, and may be presented with program listings information in another portion of the display screen. The videos may provide users with information about television programming, related products, and other television-related subject matter. Textual information may also be displayed. The textual information may correspond to the current video. For example, passive guides may include a near-full-screen video of a promoted program, plus a small text area with ordering details for the promoted program (e.g., a barker channel). Alternatively, it may include a quarter-screen video, accompanied by quarter screen text with ordering or viewing instructions, and a half-screen of scrolling program listings. These examples are merely illustrative, and other passive guide approaches may be used.

The videos that are displayed in the passive guide display screen may be distributed according to a playlist that is generated by the main facility, a distribution facility, or a combination of both. A distribution facility may, for example, track characteristics of the passive guide product, such as the currently displayed screen components of the

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passive guide display screen (e.g., videos, program listings grid, etc.), the size and location of the components, the listings that are being displayed, the period with which listings are paged or the speed with which listings are scrolled, the currently active program segment in the video portion of the guide, the content of the videos (e.g., programs or products that are promoted by a video), the channel and call letters of the passive guide, a source identifier or other identifier of the passive guide, or any other suitable information. Such characteristics or combinations of such characteristics are hereby referred to as passive guide characteristics. The passive guide characteristics may also include the playlist for the videos of the passive guide.

The distribution facilities may distribute the program guide data, playlist and other passive guide characteristics, or any suitable combination thereof, for use by an interactive program guide. The playlist and other passive guide characteristics may be provided to the interactive guide by a distribution facility as part of or separately from the program guide data normally provided to the interactive guide. The program guide may run wholly on a user's television equipment, or partially on the television equipment and partially on a program guide server. The interactive guide may overlay interactive program guide data onto the passive guide channel, or otherwise replace passive content of the passive guide with interactive content. The resulting hybrid passive-interactive guide may provide users with access to interactive content interactive guide features while the users are watching the video content of the passive guide.

The interactive program guide may use the playlist and other passive guide characteristics to enhance the display of the hybrid guide and to provide additional interactive features that may be coordinated with the passive guide display. The hybrid guide may, for example, not display listings or may scroll or page listings within an interactive portion of a hybrid guide, until a user indicates a desire to interact with the listings. When overlaying listings, the interactive guide may replace the passive listings with synchronized listings—passive or interactive listings that start at the same point in the channel lineup at which the passive listings were being displayed by the passive guide just before the synchronized listings were displayed. The type of listings (e.g., movie listings, sports listings, etc.) may be synchronized if desired. When the size of the video portion of the passive guide changes, the interactive program guide may change the size of the interactive portion or portions of the hybrid guide accordingly.

The interactive guide may also replace other types of passive guide content with interactive content. Passive guides may provide one or more passive features, such as a sports feature, in which video on a particular subject is displayed accompanied by passive information. The interactive guide may overlay the passive information with an interactive feature. Alternatively, the interactive guide may supplement a passive feature with interactive content. When, for example, the passive guide is promoting a specific product or program, the interactive guide may include a supplemental advertisement or other supplemental information for the same product or program promoted by the hybrid guide. Such advertisements may be passive or interactive. When the passive guide is displaying a video promotion for a program with associated text (e.g., channel numbers, start times, end times, etc.), the interactive guide may overlay the text with text that is more appropriate to the interactive viewers. This may be desirable when, for example, the program being promoted is available on different channels or for additional start times for viewers with advanced television equipment.

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The hybrid guide may include traditional interactive guide features that relate to the promotional content in the video portion of the passive guide. The hybrid guide may, for example, have interactive components related to a video promotion that provide users with an opportunity to purchase a program or product being advertised. The hybrid guide or an interactive guide may provide users with an opportunity to view listings for segments aired in the video portion of a passive guide. The hybrid guide or an interactive guide may also provide users with an opportunity to set reminders for listings or video segments that are displayed by the passive guide and that a user is interested in.

If desired, a user's television equipment may have multiple tuners. The hybrid guide may control the multiple tuners to provide users with an opportunity to, for example, watch regular programming while recording a passive channel segment, or vice versa. Information on passive guide characteristics may also be recorded and played back.

Further features of the invention, its nature and various advantages will be more apparent from the accompanying drawings and the following detailed description of the preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic block diagram of an illustrative system in accordance with the present invention.

FIGS. 2a–2d show illustrative arrangements for the interactive television program guide equipment of FIG. 1 in accordance with the principles of the present invention.

FIGS. 3a and 3b are two illustrative display screens for a passive television program guide.

FIG. 4 is an illustrative schematic block diagram of a user television equipment of FIGS. 2a–2d in accordance with the principles of the present invention.

FIG. 5 is a generalized schematic block diagram of portions of the illustrative user television equipment of FIG. 4 in accordance with the principles of the present invention.

FIG. 6 is an illustrative hybrid guide display screen in which an interactive program listings grid is overlaid onto a passive program listings grid in accordance with the principles of the present invention.

FIG. 7 is an illustrative hybrid guide display screen in which the interactive program listings grid of FIG. 6 has been resized to accommodate a change in size of the video portion of the hybrid guide in accordance with the principles of the present invention.

FIG. 8a is an illustrative passive guide sports feature.

FIG. 8b is an illustrative hybrid guide display screen in which the passive sports feature of FIG. 8a is overlaid by an interactive sports feature in accordance with the principles of the present invention.

FIGS. 9a and 9b are illustrative hybrid guide display screens in which the passive guide portion of the hybrid guide is overlaid with an interactive advertisement in accordance with the principles of the present invention.

FIG. 10 is an illustrative order confirmation screen in accordance with the principles of the present invention.

FIG. 11 is an illustrative hybrid guide display screen in which passive tagging information of FIG. 3a is overlaid with interactive tagging information in accordance with the principles of the present invention.

FIG. 12 is an illustrative interactive guide main menu screen having a selectable on-screen feature for providing users with access to passive guide program listings, in accordance with the principles of the present invention.

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FIG. 13 is an illustrative interactive passive guide program listings screen in accordance with the principles of the present invention.

FIG. 14 is an illustrative additional information screen in accordance with the principles of the present invention.

FIG. 15 shows an illustrative reminder list overlay in accordance with the principles of the present invention.

FIGS. 16 and 17 are flowcharts of illustrative steps involved in providing a hybrid passive-interactive program guide in accordance with the principles of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An illustrative system 10 in accordance with the principles of the present invention is shown in FIG. 1. Main facility 12 provides program guide data from data source 14 to television program guide equipment 17 via communications link 18. There may be multiple data sources but only one has been shown to avoid overcomplicating the drawing. If desired, program guide data sources may be located at facilities separate from main facility 12, such as at local information services 15, and may have their data provided to main facility 12 for localization and distribution. Data sources 14 may be any suitable computer or computer based system for obtaining data (e.g., manually from an operator, electronically via a computer network or other connection, or via storage media) and for putting the data into electronic form for distribution by main facility 12. Link 18 may be a satellite link, a telephone network link, a cable or fiber optic link, a microwave link, an Internet link, a combination of such links, or any other suitable communications link. If desired, one data source 14 or group of data sources may provide data for a passive and an interactive guide. Alternatively, data may be provided by a source or group of sources for each guide.

Local information service 15 may be any suitable facility for obtaining data particular to a localized region and for providing the data to main facility 12 over communications link 41. Local information service 15 may be, for example, a local weather station that measures weather data, a local newspaper that obtains local high school and college sporting information, or any other suitable provider of information. Local information service 15 may be a local business with a computer for providing main facility 12 with, for example, local ski reports, fishing conditions, menus, etc., or any other suitable provider of information. Link 41 may be a satellite link, a telephone network link, a cable or fiber optic link, a microwave link, an Internet link, a combination of such links, or any other suitable communications link.

The program guide data transmitted by main facility 12 to television program guide equipment 17 may include television programming data (e.g., program identifiers, times, channels, titles, and descriptions) and other data for services other than television program listings (e.g., help text, pay-per-view information, weather information, sports information, music channel information, associated Internet web links, associated software, etc.). There are preferably numerous pieces or installations of television program guide equipment 17, although only one is shown in FIG. 1 to avoid over-complicating the drawing.

Program guide data may be transmitted by main facility 12 to television program guide equipment 17 using any suitable approach. Data files may, for example, be encapsulated as objects and transmitted using a suitable Internet based addressing scheme and protocol stack (e.g., a stack

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which uses the user datagram protocol (UDP) and Internet protocol (IP)). Systems in which program guide data is transmitted from a main facility to distribution facilities are described, for example, in Gollahon et al. U.S. patent application Ser. No. 09/332,624, filed Jun. 11, 1999, which is hereby incorporated by reference herein in its entirety.

Main facility 12 may also provide videos for the passive guide to television program guide equipment 17. Videos for the passive guide may be transmitted in real-time by main facility 12 to television program guide equipment 17 for real-time distribution to the user television equipment of a number of users. Alternatively, main facility 12 may transmit or otherwise provide (e.g., on portable storage media) videos to television program guide equipment 17 for storage. Portions of television program guide equipment 17 may later distribute the videos to the user television equipment of a number of users in real-time. This approach may be referred to as a "store-and-forward" video distribution scheme. If desired, a combination of the two approaches may be used. Systems in which videos are both distributed directly in real-time and stored-and-forwarded in real-time are described, for example, in Kern et al. U.S. patent application Ser. No. 09/332,448, filed Jun. 11, 1999, which is hereby incorporated by reference herein in its entirety. The application of such an approach in a hybrid guide system is described, for example, in Knudson et al. U.S. patent application Ser. No. 09/357,941, filed Jul. 16, 1999, which is hereby incorporated by reference herein in its entirety.

Main facility 12 may distribute videos in real time or for store-and-forwarding by portions of television program guide equipment 17 using any suitable approach. As described, for example, in above-mentioned Kern et al. U.S. patent application Ser. No. 09/332,448, main facility 12 may schedule videos for distribution according to a promotional philosophy. Promotional philosophies are selection algorithms that attempt to maximize the effectiveness of promotions by selecting them for distribution during times for which expected audiences will view the promotions. An operator at main facility 12 may, for example, generate one or more promotional philosophy templates that are used by main facility 12 to generate a national playlist of promotional events. The promotional philosophy templates and national playlist may be provided to distribution facility 16 as part of the program guide data.

In approaches where alternative sources of videos are provided by main facility 12 to television program guide equipment 17, such as in the store-and-forward approach described in above-mentioned Kern et al. U.S. patent application Ser. No. 09/332,448, equipment at a distribution facility may generate a local playlist of promotional events according to the promotional philosophy templates. If the promotional events scheduled by the national playlist are unavailable or undesirable to the distribution facility, the local playlist may schedule alternative videos instead of the undesirable ones scheduled by the national playlist. The distribution facility may generate program guide display screens with the nationally selected or alternative videos and program guide data according to the local playlist. The display screens are distributed to users for viewing on their televisions.

The videos supplied by main facility 12 may include promotional videos such as short videos (i.e., videos less than three minutes in length), video trailers promoting a television program, or the like. The videos may be supplied by video source 11. Video source 11 may be based, for example, on a library of video clips stored on a video juke box (a multiple-compact disc or digital video disc storage

system) or any other suitable combination of hardware and software for storing such videos. Videos may be provided in any suitable format. For example, video signals may be provided in an analog signal format using the National Television Standards Committee (NTSC) signal format or in a digital signal format such as a Moving Picture Experts Group (MPEG) format.

If desired, data source 14 and video source 14 may be combined into a single information source. This information source may provide program guide data, videos, or any suitable combination thereof. The data it provides may be used by television program guide equipment 17 to provide a passive guide, an interactive guide, or both. The videos may be used for whole screen or partial screen displays.

Program guide data and videos may be transmitted by transmission system 24 to television program guide equipment 17 via link 18. Link 18 may be a satellite link, a telephone network link, a cable or fiber optic link, a microwave link, an Internet link, a combination of such links, or any other suitable communications link. Video signals (e.g., television programs) may also be transmitted over link 18 if desired.

Transmission system 24 may include any equipment suitable for encoding the program guide data and videos and providing the encoded data and videos to transmitter 111. Transmitter 111 is preferably a digital satellite uplink transmitter, but may be any suitable analog, digital, radio frequency, optical, microwave, terrestrial, or other type of transmitter. Transmission system 24 may encode the data as, for example, component object model (COM) objects that are transmitted using an Internet based addressing scheme and Internet based transport and network protocols such as the user datagram protocol (UDP) and the Internet protocol (IP). Electronic program guide systems that transfer UDP packets and COM objects using a UDP/IP protocol stack are described in Gollahon et al. U.S. patent application Ser. No. 09/332,624, filed Jun. 11, 1999, which is hereby incorporated by reference herein in its entirety.

An interactive television program guide is implemented on television program guide equipment 17. Various architectures for interactive television program guide systems and various interactive guide features are described, for example, in above-mentioned Knudson et al. U.S. patent application Ser. No. 09/357,941, filed Jul. 16, 1999. Four illustrative arrangements for television program guide equipment 17 are shown in FIGS. 2a-2d. As shown, television program guide equipment 17 may include distribution equipment 21 located at distribution facility 16, and user television equipment 22.

The interactive television program guide may run totally on user television equipment 22 as shown in FIGS. 2a and 2c, or may run partially on user television equipment 22 and partially on television program guide equipment 17 using a suitable client-server or distributed processing approach as shown in FIGS. 2b and 2d.

Distribution facility 16 may be any suitable distribution facility (e.g., a cable system headend, a broadcast distribution facility, a satellite distribution facility, or any other suitable type of distribution facility). Distribution facility 16 may have reception system 23 for receiving the videos, data, or a suitable combination thereof from transmitter 111 using receiver 27. Receiver 27 is preferably a digital satellite downlink receiver, but may be any suitable analog, digital, radio-frequency, optical, microwave, terrestrial, or other type of receiver.

Distribution facility 16 may have screen generator 29 for generating passive guide display screens containing the

videos and data. Screen generator 29 may be implemented using any suitable hardware, software, or combination thereof. Screen generator 29, may be, for example, a Windows NT process running on a personal computer with a Pentium II microprocessor.

Screen generator 29 may use an object-oriented approach to generate video product display screens. The use of COM objects, for example, may allow changes to be made to the format and functionality of some of the features of the system without requiring changes to other system components. Such an approach may allow one main facility 12 to provide and manage a number of different passive guides and other video products from a central location. Screen generators that may be used to create video product display screens using an object-oriented approach are described, for example, in Kern et al. U.S. patent application Ser. No. 09/332,539, filed Jun. 11, 1999, which is hereby incorporated by reference herein in its entirety.

Screen generator 29 may track passive guide characteristics such as the currently displayed screen components of the passive guide display screen (e.g., videos, program listings grid, etc.), the size and location of the components, the listings that are being displayed, the period with which listings are paged or the speed with which listings are scrolled, which program segment is currently active in the video portion of the guide, the content of the videos (e.g., programs or products that are promoted by a video), the channel and call letters of the passive guide, a source identifier or other identifier of the passive guide, or any other suitable information. If desired, local or national playlists may also be provided to the interactive guide as part of the passive guide characteristics. The passive guide characteristics may be provided to distribution equipment 21 or program guide server 25 of FIGS. 2b and 2d for use by the interactive television program guide. The passive guide characteristics may be provided to the guide or a guide client periodically, continuously, on-demand, or with any other suitable frequency based on the system architecture underlying the guide.

Screen generator 29 may track passive guide characteristics using any suitable approach. Screen generator 29 may be implemented using, for example, an object oriented approach in which display element objects (e.g., video objects, grid objects, text objects, etc.) render themselves to a display screen. The display item objects may render themselves with styles and at positions on the display screen that are defined within the display elements themselves or that are inherited based on predefined style packages. Style inheritance in a promotional material distribution system is described, for example, in above-mentioned Kern et al. U.S. patent application Ser. No. 09/332,539, filed Jun. 11, 1999. Each display item object may include methods for obtaining passive guide characteristics from the object.

A recorder object may be implemented, for example, with methods that query each display item object for its relevant characteristics (e.g., style, position, content, etc.). The recorder object may maintain the characteristics in a database. The passive guide characteristics may be recorded each time a display object is rendered to a display screen. Alternately, screen generator 29 may record the characteristics in advance of screen generation according to, for example, a national or local playlist. In still another suitable approach, main facility 12 may provide the characteristics to distribution facility 16 according to the national playlist before videos are displayed by screen generator 29.

Distribution equipment 21 may distribute the passive guide display screens on a dedicated channel and, if desired,

television programming on multiple analog or digital channels, to multiple users via communications paths 20. Distribution equipment 21 may include, for example, a cable headend modulator, and may include any other or additional equipment suitable for transmitting television programming and passive guide display screens over communications paths 20. Alternatively, distribution equipment 21 may include suitable hardware and software for delivering videos in real-time or substantially real-time via the Internet (e.g., using the M-bone). If desired, television programming and video products may be provided over separate communications paths.

Distribution equipment 21 of FIGS. 2a, 2b, 2c, and 2d may also include suitable hardware for providing program guide data and passive guide characteristics, or any suitable combination thereof, to user television equipment 22 over communications path 20. Distribution equipment 21 may include, for example, suitable transmission hardware for distributing program guide data on a television channel sideband, in the vertical blanking interval of a television channel, using an in-band digital signal, using an out-of-band digital signal, or by any other suitable data transmission technique. The data may, for example, be provided over a phone line when communications path 20 include separate paths for data and television signals.

The program guide data and passive guide characteristics may be provided to the guide continuously or periodically. If desired, the passive guide characteristics may be provided simultaneously with the program guide data, or ahead of the program guide data. The passive guide characteristics may be provided synchronously with the content of the passive guide. Alternatively, passive guide characteristics may be provided ahead of corresponding displays of the passive guide, with indications of how far in advance guide characteristics of the passive guide will occur. In the latter approach, multiple messages may be sent indicating when characteristics of the passive guide will occur. This may allow the interactive guide to compensate for variable time differences between the passive and interactive guide, and for latencies in communication paths.

Communications path 20 may be any communications path or paths suitable for distributing program guide data. Communications path 20 may include, for example, a satellite link, a telephone network link, a cable or fiber optic link, a microwave link, an Internet link, a data-over-cable service interface specification (DOCSIS) link, a combination of such links, or any other suitable communications link. Communications path 20 preferably has sufficient bandwidth to allow distribution facility 16 to distribute television programming to user television equipment 22. There are typically multiple pieces of user television equipment 22 and multiple associated communications paths 20, although only one piece of user television equipment 22 and communications path 20 are shown in FIGS. 2a-2d to avoid over complicating the drawings. If desired, television programming may be provided over separate communications paths (not shown).

FIG. 2b shows an illustrative arrangement for television program guide equipment 17 in a client-server based or distributed interactive program guide system. As shown in FIG. 2b, distribution equipment 21 may include program guide server 25. Program guide server 25 may be any suitable software, hardware, or combination thereof for providing a client-server based program guide. Program guide server 25 may, for example, run a suitable database engine (e.g., SQL Server by Microsoft) and provide program guide data, passive guide characteristics, or any suitable

combination thereof in response to queries generated by a program guide client implemented on user television equipment 22. Alternatively, program guide server 25 may poll the program guide client and provide data when necessary. If desired, program guide server 25 may be located at main facility 12 or some other location (not shown).

A program guide client running on user television equipment 22 may retrieve program guide data, passive guide characteristics, or any suitable combination thereof, from program guide server 25 using any suitable client-server based approach. The program guide client may, for example, pass SQL requests as messages to program guide server 25. In another suitable approach, the program guide may invoke remote procedures that reside on program guide server 25 using one or more remote procedure calls. Program guide server 25 may execute SQL statements for such invoked remote procedures. In still another suitable approach, client objects executed by the program guide may communicate with server objects executed by program guide server 25 using, for example, an object request broker (ORB). This may involve using, for example, Microsoft's Distributed Component Object Model (DCOM) approach.

In another approach, program guide display pages may be generated at distribution facility 16 using a high-end graphics engine or video production equipment. The display pages are then encoded into an MPEG or other suitable digital format for distribution. The program guide display pages may be decoded by a thin program guide client running on user television equipment 22 to produce program guide display screens seen by the user. Client-server based program guides of this type are described, for example, in Marshall et al. U.S. patent application Ser. No. 09/330,501, filed Jun. 11, 1999, which is hereby incorporated by reference herein in its entirety.

The program guide client may communicate with program guide server 25 over communications path 20 using any suitable network and transport layer protocols, if desired. A protocol stack may be used which includes, for example, Sequenced Packet Exchange/Internet Protocol (SPX/IPX) layers, Transmission Control Protocol/Internet Protocol (TCP/IP) layers, AppleTalk Transaction Protocol/Datagram Delivery Protocol (ATP/DDP) layers, or any other suitable network and transport layer protocols. If desired DOCSIS may also be used.

FIGS. 2c and 2d show illustrative Internet based interactive television program guide systems. Distribution facility 16 may, for example, include Internet service system 61. Internet service system 61 may use any suitable combination of hardware and software capable of obtaining or providing program guide data, passive guide characteristics, or any suitable combination thereof, for or to the guide using an Internet based approach (e.g., the HyperText Transfer Protocol (HTTP)). If desired, Internet service system 61 may be located at a facility that is separate from program guide distribution facility 16.

If the program guide is implemented on user television equipment 22 of television program guide equipment 17 as shown in FIG. 2c, Internet service system 61 (or other suitable equipment at program guide distribution facility 16 that is connected to Internet service system 61) may provide program guide data, passive guide characteristics, or any suitable combination thereof, to user television equipment 22 via the Internet, or via distribution equipment 21 using any suitable Internet-based approach (e.g., using the HyperText Transfer Protocol (HTTP) or File Transfer Protocol (FTP) over a Transmission Control Protocol/Internet Proto-

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col (TCP/IP) type link). If the program guide implemented on television program guide equipment 17 is a client-server guide as shown in FIG. 2d, program guide server 25 may obtain program guide data or passive guide characteristics from Internet service system 61. Alternatively, the data may be provided by main facility 12 to distribution facility 16 via the Internet and Internet service system 61. The program guide data may be distributed by distribution equipment 21 to the guide using any suitable distribution scheme.

In still another embodiment, distribution equipment 21 may include suitable hardware (not shown) on which a first portion or version of the interactive television program guide is implemented. A second portion or version of the program guide may be implemented on user television equipment 22. The two versions or portions of the interactive program guide may communicate using any suitable peer-to-peer communications scheme (e.g., messaging, remote procedure calls, etc.) and perform interactive program guide functions distributively between distribution facility 16 and user television equipment 22.

The passive guide display screens may include any suitable combination of videos, listings, text, graphics and other content. For example, passive guides may include a near-full-screen video of a promoted program, plus a small text area with ordering details for the promoted program (e.g., a barker channel). Alternatively, it may include a quarter screen video, accompanied by quarter screen text with ordering or viewing instructions, and a half-screen of scrolling program listings. These examples are merely illustrative, and other passive guide approaches may be used.

Two suitable illustrative passive guide display screens are shown in FIGS. 3a-3b. Passive guide display screens may be divided into one or more display areas. The display areas may, for example, include video display areas, graphic display areas, text display areas, program listings areas, or any suitable combination thereof. Video display areas may display video promotional material. They may, for example, provide a video clip of a pay-per-view selection being promoted, such as a video clip of the movie Terminator. Text display areas may display text describing the promotional video ("tagging" information). Program listings areas may display television program listings in any suitable format, such as any suitable list, table, or grid.

Display areas may be sized to occupy predefined portions of the screen. They may, for example, be sized to fit in the right or left quarter of the screen, in the top or bottom half of the screen, in the top or bottom one-third of the screen, in the top or bottom two-thirds of the screen, as a full screen, etc. Display areas may display promotional events that correspond to the display area type (e.g., text, video, program listings, etc.).

FIG. 3a shows one suitable combination of display areas for an illustrative passive television program guide. Illustrative passive guide display screen 80 may include, for example, video display area 82, text display area 84, and program listings area 85. Video display area 82 may be sized, for example, to fit in the top left quarter of the display screen. Video display area 82 may display video clips, such as promotions, short form videos, and trailers to provide users with information about television programming, related products, and other television-related subject matter. In this example, video display area 82 is displaying a video clip of the movie Terminator. Text display area 84 may be sized, for example, to fit in the top right quarter of the screen and may be used to display tagging information about, for example, when Terminator airs and on what channel it airs.

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Video display area 82 and text promotion area 84 may be switched if desired.

FIG. 3a also illustrates the display of program listings grid 88 in program listings area 85. Program listings area 85 has been sized, for example, to fit in the bottom half of the screen. The sizes of the video, text and listings portion may change during the course of the passive guide's display. Program listings grid 88 may be divided into a number of columns 90 which correspond to program broadcast times and which may be equally spaced apart (e.g., in thirty-minute steps), and a number of rows 92 where each row 92 corresponds to a different channel. Program listings grid 88 may be scrolled continuously or have its pages changed periodically to display program listings for additional channels. Program listings may be displayed in the grid in sub-sets according to one or more organization criteria and sorted in various ways. The current time may be displayed by clock 101. Another suitable illustrative display screen for a passive guide is shown in FIG. 3b. Passive guide display screen 81 of FIG. 3b may be an alternative display mode for the screen of FIG. 3a. Passive guide display screen 81 of FIG. 3b may include, for example, video display area 91, graphic display area 87 and program listings area 85. Video display area 91 may, for example, be sized to fit in the top-half portion of passive guide display screen 81. Graphic display area 87 may include a still or animated graphic, such as a brand logo. Graphic display area 87 may be omitted if desired.

Promotional material display screens 80 and 81 of FIGS. 3a-3b are only illustrative, and any suitable combination and arrangement of display areas may be used by system 10 to provide a number of different video products with different video product display screens that differ in appearance.

An illustrative arrangement for user television equipment 22 is shown in FIG. 4. User television equipment 22 of FIG. 4 receives video signals and data from distribution facility 16 or program guide server 25 at input 26. During normal television viewing, a user tunes set-top box 28 to a desired television channel. The signal for that television channel is then provided at video output 30. The signal supplied at output 30 is typically either a radio-frequency (RF) signal on a predefined channel (e.g., channel 3 or 4), or an analog demodulated video signal, but may also be a digital signal provided to television 36 on an appropriate digital bus (e.g., a bus using the Institute of Electrical and Electronics Engineers (IEEE) 1394 standard, (not shown)). The video signal at output 30 is received by optional secondary storage device 32.

The interactive television program guide may run on set-top box 28, on television 36 (if television 36 has suitable processing circuitry and memory), on a suitable analog or digital receiver connected to television 36, or on digital storage device 31 if digital storage device 31 has suitable processing circuitry and memory. The interactive television program guide may also run cooperatively on a suitable combination of these devices. Interactive television application systems in which a cooperative interactive television program guide application runs on multiple devices are described, for example, in Ellis U.S. patent application Ser. No. 09/186,598, filed Nov. 5, 1998, which is hereby incorporated by reference herein in its entirety.

Secondary storage device 32 can be any suitable type of analog or digital program storage device or player (e.g., a videocassette recorder, a digital versatile disc (DVD) player, etc.). Program recording and other features may be controlled by set-top box 28 using control path 34. If secondary

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storage device 32 is a videocassette recorder, for example, a typical control path 34 involves the use of an infrared transmitter coupled to an infrared receiver in the videocassette recorder that normally accepts commands from a remote control such as remote control 40. Remote control 40 may be used to control set-top box 28, secondary storage device 32, and television 36.

If desired, a user may record programs, program guide data, passive guide videos, or a combination thereof in digital form on optional digital storage device 31. Digital storage device 31 may be a writeable optical storage device (such as a DVD player capable of handling recordable DVD discs), a magnetic storage device (such as a disk drive or digital tape), or any other digital storage device. Interactive television program guide systems that have digital storage devices are described, for example, in Hassell et al. U.S. patent application Ser. No. 09/157,256, filed Sep. 17, 1998, which is hereby incorporated by reference herein in its entirety.

Digital storage device 31 can be contained in set-top box 28 or it can be an external device connected to set-top box 28 via an output port and appropriate interface. Digital storage device 31 may, for example, be contained in a local media server. If necessary, processing circuitry in set-top box 28 formats the received video, audio and data signals into a digital file format. Preferably, the file format is an open file format such as the Moving Picture Experts Group (MPEG) MPEG-2 standard or the Moving Joint Photographic Experts Group (MJPEG) standard. The resulting data is streamed to digital storage device 31 via an appropriate bus (e.g., a bus using the Institute Electrical and Electronics Engineers (IEEE) 1394 standard), and is stored on digital storage device 31. In another suitable approach, an MPEG-2 data stream or series of files may be received from distribution equipment 21 and stored.

Television 36 receives video signals from secondary storage device 32 via communications path 38. The video signals on communications path 38 may either be generated by secondary storage device 32 when playing back a pre-recorded storage medium (e.g., a videocassette or a recordable digital video disc), by digital storage device 31 when playing back a prerecorded digital medium, may be passed through from set-top box 28, may be provided directly to television 36 from set-top box 28 if secondary storage device 32 is not included in user television equipment 22, or may be received directly by television 36. During normal television viewing, the video signals provided to television 36 correspond to the desired channel to which a user has tuned with set-top box 28. Video signals may also be provided to television 36 by set-top box 28 when set-top box 28 is used to play back information stored on digital storage device 31.

Set-top box 28 may have memory 44. Memory 44 may be any memory or other storage device, such as a random access memory (RAM), read only memory (ROM), flash memory, a hard disk drive, a combination of such devices, etc., that is suitable for storing program guide application instructions, program guide data, and passive guide characteristics for use by the program guide.

In client-server based approaches, set-top box 28 may have communications device 37 for communicating directly with program guide server 25 or Internet service system 61 over communications path 20. Communications device 37 may be a modem (e.g., any suitable analog or digital standard, cellular, or cable modem), network interface card (e.g., an Ethernet card, Token ring card, etc.), or other

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suitable communications device. Communications device 37 may also be a personal computer with an Internet connection in, for example, the arrangement shown in FIGS. 2c and 2d. Television 36 may also have such a suitable communications device if desired. In an alternative approach, user television equipment 22 may communicate with Internet service system 61 via distribution equipment 21 using a suitable return path.

A more generalized embodiment of user television equipment 22 of FIG. 4 is shown in FIG. 5. As shown in FIG. 5, program guide data from distribution facility 16 (FIG. 1) is received by control circuitry 42 of user television equipment 22. The functions of control circuitry 42 may be provided using the set-top box arrangement of FIGS. 2a and 2b. Alternatively, these functions may be integrated into an advanced television receiver, personal computer television (PC/TV), or any other suitable arrangement. If desired, a combination of such arrangements may be used.

User television equipment 22 may also have secondary storage device 47 and digital storage device 49 for recording programming. Secondary storage device 47 can be any suitable type of analog or digital program storage device (e.g., a videocassette recorder, a digital versatile disc (DVD), etc.). Program recording and other features may be controlled by control circuitry 42. Digital storage device 49 may be, for example, a writeable optical storage device (such as a DVD player capable of handling recordable DVD discs), a magnetic storage device (such as a disk drive or digital tape), or any other digital storage device.

User television equipment 22 may also have memory 63. Memory 63 may be any memory or other storage device, such as a random access memory (RAM), read only memory (ROM), flash memory, a hard disk drive, a combination of such devices, etc., that is suitable for storing program guide application instructions and program guide data for use by control circuitry 42.

User television equipment 22 of FIG. 4 may also have communications device 51 for supporting communications between the program guide and distribution equipment 21, program guide server 25, or Internet service system 61 via communications path 20. Communications device 51 may be a modem (e.g., any suitable analog or digital standard, cellular, or cable modem), network interface card (e.g., an Ethernet card, Token ring card, etc.), or other suitable communications device.

A user controls the operation of user television equipment 22 with user input device 46. User input device 46 may be a pointing device, wireless remote control, keyboard, touchpad, voice recognition system, or any other suitable user input device. To watch television, a user instructs control circuitry 42 to display a desired television channel on display device 45. Display device 45 may be any suitable television, monitor, or other suitable display device. To access the functions of the program guide, a user instructs the program guide implemented on television program guide equipment 17 to generate a main menu or other desired program guide display screen for display on display device 45.

The hybrid guide may provide users with any number of interactive guide features while simultaneously providing users with the video portion of a passive guide. Any suitable interactive guide feature may be provided to replace portions of the passive guide or to supplement the passive guide. Interactive guide features may be coordinated with the contents of the passive guide based on the playlists and other passive guide characteristics provided to the interactive guide.

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A hybrid guide may be generated automatically when user television equipment 22 tunes to the passive guide channel. User television equipment 22 may tune to the passive guide channel with remote control 40 (FIG. 4), or under the control of the interactive television program guide. The interactive guide may direct control circuitry 42 to tune to the passive guide channel when, for example, the user enters the channel number of the passive guide directly, or when the user flips channels until control circuitry 42 tunes to the passive guide channel. In still another approach, the user may access the passive guide directly by pressing a suitable key on user input device 46, or by selecting an on-screen option when in the interactive television program guide.

The hybrid guide may be generated by the interactive guide using any suitable overlay technique to overlay program listings display areas, text display areas, graphic display areas, video display areas, or interactive feature areas onto the passive guide display screen. Interactive feature areas may include any suitable interactive program guide feature and may replace or supplement a passive feature of the passive guide. The interactive guide may generate the hybrid guide immediately when a user tunes to the passive guide channel. Alternatively, the interactive guide may wait to generate the hybrid guide until the user indicates a desire to access interactive features with user input device 46.

The interactive guide may, for example, overlay a passive listings display area (e.g., program listings areas 85 of FIGS. 3a and 3b) with an interactive listings area in response to a user indicating a desire to select a program listing by, for example, pressing an arrow key on remote control 40. The interactive guide may determine the first program listing displayed based, for example, on the passive guide characteristics, and may display the interactive listings starting with that first program listing. The interactive guide may, for example, determine the current time slot and channel for which listings are displayed by the passive guide based, for example, on the passive guide characteristics, and may display interactive listings for the same time slot and channel, thereby starting the interactive listings with the same listing as the passive listings. In still another suitable approach, the interactive guide may determine the type of listings displayed (e.g., whether they are movie listings, spots listings, etc.), and display interactive listings for the same type.

The interactive guide may indicate to a user that a hybrid guide is active by, for example, displaying a highlight region in a program listings display area. FIG. 6 shows an illustrative hybrid guide having interactive grid 601 and highlight region 151. The user may position highlight region 151 by entering appropriate commands with user interface 26. For example, if user input interface 46 has a keypad, the user can position highlight region 151 using "up," "down," "left," and "right" cursor keys. Program listings may also be panned left, right, up, and down by positioning highlight region 151 using the cursor keys on user input device 46. Alternatively, a touch sensitive screen, trackball, voice commands, or other suitable device may be used to move highlight region 151 or to select program listings without the use of highlight region 151. In still another approach, the user may speak the title of a television program listing into a voice request recognition system which will issue an appropriate command or request to the interactive guide. Any other suitable approach may also be used.

After a user selects a program listing, the interactive program guide may provide the user with an opportunity to access a number of program guide features. For example, the

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user may access additional information (typically text or graphics, but possibly video if desired) about the listing, schedule an associated program reminder, or schedule an associated program for recording by one or more of digital storage device 49 (FIG. 5), secondary storage device 47 (FIG. 5), or program guide server 25. Systems in which programs are remotely recorded on servers are described, for example, in Ellis et al. U.S. patent application Ser. No. 09/332,244, filed Jun. 11, 1999, which is hereby incorporated by reference herein in its entirety.

The sizes of the different display areas of a passive guide may change during their lifetimes. A display screen having a half-screen video display area and a half-screen listings area may have its display areas resized, for example, to a two-thirds screen video display area and a one-third screen program listings area. The passive guide characteristics may indicate that the sizes of the display areas will change or have been changed. The interactive guide may resize an interactive program listings display area, or other display area, accordingly. An illustrative display screen in which an interactive program listings area has been resized is shown in FIG. 7.

The interactive guide may replace any other passive content of the passive guide with interactive content. Passive guides may include one or more features in which video for a particular subject is displayed accompanied by information related to the subject. For example, the passive guide may include a passive sports feature as shown in FIG. 8a. The sports feature may include, for example, a video display area for displaying a sports talk show, an a program listings area in which only program listings for sports are displayed. The passive guide characteristics, playlists, or both, may indicate when the passive guide displays the sports feature and its corresponding video. If desired, the characteristics may indicate the content of the video, such as the type of sports that are being discussed. In this example, the video display area is displaying a talk show about football.

Based on the passive guide characteristics, playlists, or both, the interactive guide may determine that a football talk show feature is being displayed and may overlay the passive sports listings with an interactive sports feature as shown in FIG. 8b. If desired, the interactive feature may run wholly on user television equipment 22. Alternatively, the interactive guide may launch a web browser and automatically access a web site, as shown in FIG. 8b.

The interactive guide may supplement passive content of a passive guide with interactive content. For example, the interactive guide may determine, based on the playlists or other passive guide characteristics, that the passive guide is promoting a specific product or program. The interactive guide may overlay a supplemental advertisement or other supplemental information for the same product or program onto the passive guide display screen. The interactive guide may include such advertisements or information in a graphic display area, such as graphic display area 87 of FIG. 3b, but any suitable display area and overlay relationship may be used. FIGS. 9a and 9b show illustrative display screens in which an interactive advertisement banner 910 is overlaid onto video display area 91. In FIG. 9a, the display screen includes passive program listings grid 88. In FIG. 9b, the display screen includes interactive grid 601.

The guide may also provide interactive components related to a video promotion that, for example, provide users with an opportunity to order programs or products associated with the video promotion. In response to a user selecting interactive advertisement banner 910, the guide may

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display an order confirmation screen, such as order confirmation screen 791 of FIG. 10. Order confirmation screen 791 may prompt a user for a purchase code. After a user enters a correct purchase code, the program guide may allow the user to watch the program and register the purchase with distribution facility 16. If the program is about to start or has already started, the program guide may tune to the channel on which the program is carried. If the ordered pay-per-view will not start for some time in the future, the program guide may set a reminder for the pay-per-view program.

The interactive guide may also overlay a text display area over a passive guide text display area, such as text display area 84 of FIG. 3a, to provide users with text that is more appropriate to the interactive viewer. FIG. 11 illustrates this feature of the hybrid guide. In the example of FIG. 11, the passive guide is currently displaying a video promotion for the pay-per-view TERMINATOR. The hybrid guide may, for example, provide users with an opportunity to access additional air times or channels for pay-per-view programs. Such air times or channels may supplement the air times or channels displayed by a passive guide. In the example of FIG. 11, users may select text display area 1101 and arrow right or left to see additional air times or channels. Users may, for example, arrow up or down to switch between selecting air times and channels. In still another suitable approach, the interactive guide may determine that there are additional air times or channels and display the air times or channels in a passive text display area overlaying the text display area of the passive guide. If desired, passive program listings grid 88 may be overlaid with an interactive guide.

The interactive guide may also provide users with traditional guide features that operate based on the playlists or other passive guide characteristics. The guide may, for example, provide users with an opportunity to view program listings for passive guide videos. A user may access program listings for passive guide videos via an interactive guide main menu. Users may access the menu by, for example, pressing a "menu" key on remote control 40.

A main menu screen, such as illustrative main menu screen 100 of FIG. 12, may include menu 102 of selectable program guide features 106. If desired, program guide features 106 may be organized according to feature type. In menu 102, for example, program guide features 106 have been organized into three columns. The column labeled "TV GUIDE" is for listings related features, the column labeled "MSO SHOWCASE" is for multiple service organization (MSO) related features, and the column labeled "VIEWER SERVICES" is for viewer related features. The interactive television program guide may generate a display screen for a particular program guide feature when a user selects that feature from menu 102 with, for example, highlight region 120.

Main menu screen 100 may include one or more selectable advertisements 108. Selectable advertisements 108 may, for example, include text and graphics advertising pay-per-view programs or other programs, channels, or products. When a user selects a selectable advertisement 108 with, for example, highlight region 120, the program guide may display information (e.g., pay-per-view information) or take other actions related to the content of the advertisement. Pure text advertisements may be presented, if desired, as illustrated by selectable advertisement banner 110.

Main menu screen 100 may also include other screen elements. The brand of the program guide product may be indicated, for example, using a product brand logo graphic such as product brand logo graphic 112. The identity of the

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television service provider may be presented, for example, using a service provider logo graphic such as service provider logo graphic 114. The logos may be included in the program guide data allowing for on-the-fly configurability of the display screens. The current time may be displayed in clock display region 116. In addition, a suitable indicator such as indicator graphic 118 may be used to indicate to a user that mail from a cable operator or program guide provider is waiting for a user if the program guide supports messaging functions.

A user may indicate a desire to view program listings for passive guide videos by, for example, selecting selectable Passive Guide feature 106. In response, the interactive guide may generate a program listings screen that includes program listings information for the passive guide videos based on the playlists or other passive guide characteristics. An illustrative listings screen is shown in FIG. 13.

Program listings screen 130 of FIG. 13 may include highlight region 151, which highlights a program listing 150. A user may position highlight region 151 by entering appropriate commands with user input device 46. For example, if user input device 46 has a keypad, a user can position highlight region 151 using "up" and "down" arrow keys on remote control 40. In response to users pressing "up" and "down" arrows on remote control 40, the interactive guide may highlight a corresponding on-screen arrow 913 to indicate that an arrow key has been pressed.

A user may select a listing by, for example, pressing on the "OK" or "info" key on remote control 40. Alternatively, a touch sensitive screen, trackball, voice recognition device, or other suitable device may be used to move highlight region 151 or to select program listings without the use of highlight region 151. In still another approach, a user may speak a passive guide program listing into a voice request recognition system. These methods of selecting program listings are merely illustrative. Any other suitable approach for selecting program listings may be used if desired.

A user may view additional listings by, for example, pressing an "up" or "down" arrow, or a "page up" or "page down" key on remote control 40. The user may also see listings for the next 24 hour period, or the last 24 hour period, by pressing a "day forward" or "day backward" key on remote control 40, respectively. If there are no listings starting exactly 24 hours in the indicated direction, the program guide may pick programs starting at either closer or further than 24 hours away. If desired, the program guide may require a user to scroll through advertisement banner 110.

Users may wish to obtain additional information about a passive guide video segment or its contents. Users may indicate a desire to obtain additional information by, for example, selecting a listing within listings screen 130. Alternatively, users may indicate a desire to access additional information for a video segment by, for example, pressing an "info" key on remote control 40 while viewing the segment with the hybrid guide.

When a user indicates a desire to view additional information for a passive guide video segment, the interactive guide may display an additional information screen for the video segment. FIG. 14 shows illustrative additional information screen 691 that the interactive guide may display when, for example, a user indicates a desire to access additional information for a "Family Programming" segment. Additional information screen 691 may provide users with an opportunity to access other interactive guide features for passive guide video segments. Interactive guide systems

in which additional information screens provide users with access to interactive guide features are described, for example, in Rudnick et al. U.S. patent application Ser. No. 09/356,268, filed Jul. 16, 1999, which is hereby incorporated by reference herein in its entirety.

The interactive guide may provide users with an opportunity to access a list of program listings for programs promoted in the video segment. The passive guide characteristics provided to the interactive guide may include, for example, lists of programs associated with a given passive program guide video segment. When a user indicates a desire to access the list of associated programs by, for example, selecting onscreen LISTINGS feature 697, the interactive guide may obtain program listings information for the associated programs in the list. The interactive guide may display a program listings screen for the associated programs, such as program listings screen 130 of FIG. 13.

The interactive guide may also provide users with an opportunity to schedule reminders for video segments or for programs promoted within segments. Users may also schedule "on-going" reminders for series of segments or series of programs within segments. This may be accomplished in a similar manner as scheduling reminders for television program series as described, for example, in Knudson et al. U.S. patent application Ser. No. 09/330,792, filed Jun. 11, 1999, which is hereby incorporated by reference herein in its entirety.

Users may indicate a desire to schedule reminders for particular video segments by, for example, selecting a video segment from listings screen 130 and pressing a suitable key, such as a "remind" key, on remote control 40. Alternatively, users may indicate a desire to schedule reminders for segments by selecting on-screen REMIND feature 695 in additional information screen 691. When a user indicates a desire to schedule a reminder for a video segment, the interactive guide may schedule a reminder for the segment based, for example, on a segment identifier in the passive guide characteristics. Any suitable approach for scheduling reminders with an interactive guide may be used. In addition, users may also schedule reminders for programs promoted in a segment by, for example, accessing listings associated with a segment and scheduling a reminder using any suitable approach. If desired, users may be prompted to schedule an on-going or "series" reminder for the video segment.

The interactive program guide may remind a user that a passive guide video segment or associated program (or segment or program in a series for an ongoing reminder) is airing at the time the segment or associated program airs. In an alternative approach, the interactive program guide may remind a user at some predetermined period of time before the video segment or associated program airs. FIG. 15 shows illustrative reminder list 971. Reminder list 971 may be overlaid on top of the currently displayed television program to provide a user with an opportunity to view a reminder while still viewing a portion of the television program that a user is watching. The interactive program guide may provide a user with an opportunity to scroll through reminder list 971 by, for example, using remote control arrow keys. The interactive program guide may hide reminder list 971 when, for example, a user selects hide reminder feature 972. The guide may also display reminder list 971 if, for example, the user presses an "OK" key at any time while watching TV. Reminder list 971 of FIG. 15 lists reminders for a family programming video segment and its associated programs because, for example, reminders have been scheduled for both.

The hybrid guide may provide users with an opportunity to record video segments or associated programs with one or more of digital storage device 49 (FIG. 5), secondary storage device 47 (FIG. 5), or program guide server 25 (FIGS. 2b and 2d). Systems in which programs are remotely recorded on servers are described, for example, in above-mentioned Ellis et al. U.S. patent application Ser. No. 09/332,244, filed Jun. 11, 1999. Users may also record series of video segments or promoted programs. This may be accomplished in a similar manner as television program series are recorded as described, for example, in above-mentioned Knudson et al. U.S. patent application Ser. No. 09/330,792, filed Jun. 11, 1999.

Users may indicate a desire to record a passive guide segment by, for example, pressing a "record" key on remote control 40 while watching the video segment with the hybrid guide. In response, the interactive guide may direct digital storage device 49, secondary storage device 47, or program guide server 25 to record the passive guide channel using any suitable approach. Alternatively, users may indicate a desire to record passive guide video segments by, for example, selecting a segment listing from within program listings screen 130 of FIG. 13 and pressing a "record" key on remote control 40. If the segment is not currently being aired, the interactive guide may schedule the segment for recording using any suitable approach. Users may also indicate a desire to record passive guide video segments or associated programs by selecting on-screen RECORD feature 693 (FIG. 14) from within additional information screens for the segments or programs, respectively. In still another suitable approach, associated programs may be recorded by, for example, selecting an associate program listing and pressing a "record" key on remote control 40.

If desired, control circuitry 42 may have sufficient tuning circuitry to provide for tuning to multiple channel simultaneously. This approach may allow users to watch one channel, while simultaneously recording the passive guide or a program associated with a passive guide video segment from another channel. Systems in which interactive television program guides provide for the simultaneous watch and record of programs from multiple channels are described, for example, in Lemmons et al. U.S. patent application Ser. No. 09/329,850, filed Jun. 11, 1999, which is hereby incorporated by reference herein in its entirety.

Either the entire passive guide channel display or just the video display area may be recorded. When the entire passive guide channel display is recorded, the interactive guide may also record the passive guide characteristics associated with the passive guide channel for the recorded time period. Corresponding program guide data for display in the hybrid guide may also be recorded. When the passive guide channel is played back, the interactive guide may provide users with an opportunity to access interactive features and information related to the recorded passive guide segment, just as if the passive guide segment were originally aired and as if the hybrid guide would have been provided. Systems in which programs and program guide data are recorded on digital recording devices and in which users are provided with an opportunity to access the data as if the programs were originally aired are described, for example, in above-mentioned Hassell et al. U.S. patent application Ser. No. 09/157,256, filed Sep. 17, 1998.

When just the video portion of the passive guide channel is recorded, the interactive guide may determine where the video portion of the passive guide is displayed based on, for example, the passive guide characteristics. More specifically, the passive guide characteristics may include an

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identifier of the desired segment and the coordinates of the segment as it is displayed on the passive guide display screen. Control circuitry 42 may be programmed with suitable video capture software. The interactive guide may direct control circuitry 42 to capture the video display area of the passive guide display screen and record it as a digital stream. The interactive guide may also, if desired, record the passive guide characteristics and program guide data for the time period during which the desired segment is aired.

When just the video display of the passive guide is recorded, the interactive guide may play back the recorded video alone, or may generate a hybrid guide display as though the hybrid guide were being presented at the original time the video was aired. If the video alone is played back, control circuitry 42 may be programmed to expand and center the recorded video so that the video is played back in a format more suitable for being played back alone (i.e., without the other display areas of the passive guide channel).

FIG. 16 shows a flowchart of illustrative steps involved in providing a hybrid passive-interactive program guide in accordance with the principles of the present invention. The steps shown in FIG. 16 may be performed in any suitable order, and various steps and substeps may be omitted if desired.

At step 600, program guide data is provided to the interactive guide implemented on television program guide equipment 17. This step may include one or more substeps. Providing program guide data may include, for example, providing program guide data from main facility 12 or other sources to distribution equipment 21 for distribution to an interactive program guide implemented on user television equipment 22, such as in the approach shown in FIG. 2a (step 602). Alternatively, program guide data may be provided to program guide server 25 for distribution to a program guide client as data or included in digital frames, such as in the approach shown in FIG. 2b (step 604). In still another suitable approach, program guide data may be provided to distribution equipment 21 or program guide server 25 via the Internet and Internet service system 61, such as shown in FIGS. 2c and 2d (step 606).

At step 610, passive guide characteristics are provided to the interactive program guide implemented on television program guide equipment 17. Passive guide characteristics may include any suitable information indicating the content of the passive guide product, such as the screen components of the passive guide display screen (e.g., videos, program listings grid, etc.), the size and location of the components, the listings that are being displayed, the period with which listings are paged or the speed with which listings are scrolled, which program segment is currently active in the video portion, the content of the videos (e.g., programs or products that are promoted by a video), the channel and call letters of the passive guide, a source identifier or other identifier of the passive guide, or any other suitable information. The passive guide characteristics may also include national or local playlists according to which passive guide videos are displayed.

Providing passive guide characteristics to the interactive guide may include one or more substeps. Providing passive guide characteristics may include, for example, generating the passive guide characteristics at main facility 12 and providing the characteristics to television program guide equipment 17 with the program guide data (step 612). Alternatively, suitable hardware in distribution facility 16, such as screen generator 29, may generate the passive guide characteristics. The characteristics may be generated, for

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example, while screen generator 28 generates passive guide display screens for distribution. Alternatively, the passive guide characteristics may be generated based on a national or local playlist before the actual display screens are generated. The characteristics may be distributed with or apart from the program guide data using any suitable distribution approach depending on the architecture of the program guide system.

At step 620, suitable hardware in user television equipment 22, such as suitable tuning circuitry in control circuitry 42 (FIG. 5), tunes to the passive guide channel. Such circuitry may tune to the passive guide channel directly in response to the user tuning to the channel with remote control 40 (FIG. 4), or may tune under the direction of the interactive television program guide.

The interactive guide may direct control circuitry 42 to tune to the passive guide channel in response to the user indicating a desire to access the passive guide. The user may indicate such a desire by entering a suitable command with user input device 46. The user may, for example, tune to the passive guide by entering the channel number of the passive guide directly, or by flipping channels until control circuitry 42 tunes to the passive guide channel. In still another approach, the user may access the passive guide directly by pressing a suitable key on user input device 46, or by selecting an on-screen option when in the interactive television program guide.

A hybrid guide is generated at step 630. The hybrid guide may be generated by the interactive guide using any suitable overlay technique to overlay program listings display areas, text display areas, graphic display areas, video display areas, or interactive feature areas onto the passive guide display screen. Interactive feature areas may include any suitable interactive feature presented by the program guide to replace or supplement a passive feature of the passive guide. The interactive guide may generate the passive guide immediately when a user tunes to the passive guide channel. Alternatively, the interactive guide may wait to generate the hybrid guide until the user indicates a desire to access interactive features with user input device 46. For example, the guide may overlay passive listings with interactive listings in response to a user indicating a desire to select a program listing by pressing an arrow key on remote control 40.

FIG. 17 is a flowchart of illustrative steps involved in generating a hybrid guide in accordance with the principles of the present invention. The steps shown in FIG. 17 may be performed in any suitable order, and various steps and substeps may be omitted if desired.

At step 720, the interactive program guide provides interactive content to the user with the video of the passive guide. The interactive guide may provide any suitable interactive content. The interactive guide may, for example, replace the program listings area of a passive guide (e.g., program listings areas 85 of FIGS. 3a and 3b) with an interactive listings area (step 722). The interactive guide may determine the current time slot and channel for which listings are displayed by the passive guide based, for example, on the passive guide characteristics, and may display interactive listings for the same time slot and channel.

The interactive guide may replace passive features of the passive guide with interactive ones (step 724). The interactive guide may, for example, overlay a display area of the passive guide with an interactive feature area to generate a hybrid guide with the interactive feature. The interactive

guide may provide supplemental advertisements based on the playlist or other passive guide characteristics (step 726). The supplemental advertisements may be passive or interactive. The interactive guide may replace tagging information of the passive guide with more suitable tagging information at step 728, and may adjust the sizes of any interactive display areas based on the change in sizes of other passive guide display areas, at step 730.

The hybrid guide may also include feature of the interactive guide that operate based on features of the passive guide. At step 760, additional guide features are provided. The additional guide features may include, for example, providing users with an opportunity to access program listings for passive guide videos (step 762), providing users with an opportunity to schedule reminders for passive guide videos or associated programs (764), providing users with an opportunity to record passive guide videos (step 766), or providing users with an opportunity to purchase programs or related merchandise (step 768).

The foregoing is merely illustrative of the principles of this invention and various modifications can be made by those skilled in the art without departing from the scope and spirit of the invention.

What is claimed is:

1. A hybrid passive-interactive television program guide system comprising:

a main facility comprising:

a data source configured to provide program guide data having program listings information; and

a transmitter configured to transmit the program guide data to television program guide equipment on which an interactive television program guide is implemented, wherein:

the television program guide equipment comprises:

a receiver configured to receive the program guide data;

a screen generator configured to generate a passive guide display screen in which the program listings information is displayed, wherein the program listings start with a given program listing;

user television equipment on which the interactive television program guide is at least partially implemented;

distribution equipment configured to distribute program guide data, passive guide characteristics, and the passive guide display screen to the user television equipment, wherein the passive guide display screen is distributed over a given television channel; and

the interactive television program guide is programmed to overlay the program listings information of the passive program guide display screen with interactive television program listings, wherein the interactive television program listings start at the given program listing based on the passive guide characteristics.

2. The system defined in claim 1 wherein the interactive television program guide is further programmed to determine the type of the given program listings and to display interactive program listings of the same type.

3. The system defined in claim 1 wherein the interactive television program guide is programmed to overlay the program listings information of the passive program guide display screen with interactive television program listings after a user indicates a desire to interact with the program listings information of the passive program guide display screen.

4. The system defined in claim 1 wherein the screen generator is further programmed to generate the passive guide characteristics.

5. The system defined in claim 1 wherein the passive guide characteristics includes a playlist.

6. The system defined in claim 1 wherein:

videos are displayed in a video display area;

the program listings information is displayed in a passive program listings area;

the interactive program listings are displayed in an interactive program listings area overlaid onto the passive program listings area; and

the interactive television program guide is further programmed to resize the interactive program listings area based on the passive guide display characteristics when the video display area changes in size.

7. A hybrid passive-interactive television program guide system comprising:

a main facility comprising:

a data source configured to provide program guide data having program listings information;

an information source configured to provide information for a passive guide feature selected from the group of information comprising video and data;

a transmitter configured to transmit the program guide data to television program guide equipment on which an interactive television program guide is implemented, wherein:

the television program guide equipment comprises:

a receiver configured to receive the program guide data;

a screen generator configured to generate a passive guide display screen in which the information for a passive guide feature and the program listings information are displayed;

user television equipment on which the interactive television program guide is at least partially implemented;

distribution equipment configured to distribute program guide data, passive guide characteristics, and the passive guide display screen to the user television equipment, wherein the passive guide display screen is distributed over a given television channel; and

the interactive television program guide is programmed to overlay an interactive feature onto the passive guide display screen, wherein the interactive feature corresponds to the passive guide feature and is based on the passive guide characteristics.

8. The system defined in claim 7 wherein the interactive television program guide is programmed to overlay an interactive Internet-based feature onto the passive guide display screen, wherein the interactive Internet-based feature corresponds to the passive guide feature and is based on the passive guide characteristics.

9. The system defined in claim 7 wherein the screen generator is further programmed to generate the passive guide characteristics.

10. The system defined in claim 7 wherein the passive guide characteristics includes a playlist.

11. A hybrid passive-interactive television program guide system comprising:

a main facility comprising:

a data source configured to provide program guide data having program listings information;

an information source configured to provide passive guide content;

a transmitter configured to transmit the program guide data to television program guide equipment on which an interactive television program guide is implemented, wherein:

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the television program guide equipment comprises:

a receiver configured to receive the program guide data;
a screen generator configured to generate a passive guide display screen in which the passive guide content is displayed;

user television equipment on which the interactive television program guide is at least partially implemented;
distribution equipment configured to distribute program guide data, passive guide characteristics, and the passive guide display screen to the user television equipment, wherein the passive guide display screen is distributed over a given television channel; and

the interactive television program guide is programmed to overlay a supplemental advertisement onto the passive guide display screen, wherein the supplemental advertisement corresponds to passive guide content displayed in the passive guide display screen and is based on the passive guide characteristics.

12. The system defined in claim 11 wherein the supplemental advertisement is an interactive advertisement.

13. The system defined in claim 11 wherein the interactive television program guide is further programmed to provide a user with an opportunity to order a program associated with passive guide content displayed in the passive guide display screen, based on the passive guide characteristics.

14. The system defined in claim 11 wherein the interactive television program guide is further programmed to provide a user with an opportunity to order merchandise associated with passive guide content displayed in the passive guide display screen, based on the passive guide characteristics.

15. The system defined in claim 11 wherein the screen generator is further programmed to generate the passive guide characteristics.

16. The system defined in claim 11 wherein the passive guide characteristics includes a playlist.

17. A hybrid passive-interactive television program guide system comprising:

a main facility comprising:

a data source configured to provide program guide data having program listings information;

a video source configured to provide videos;

a transmitter configured to transmit the program guide data having program listings information to television program guide equipment on which an interactive television program guide is implemented, wherein:

the television program guide equipment comprises:

a receiver configured to receive the program guide data;

a screen generator configured to generate a passive guide display screen having a video display area in which the videos are displayed, and a first text display area in which text is displayed, wherein the text corresponds to the video displayed in the video display area;

user television equipment on which the interactive television program guide is at least partially implemented;

distribution equipment configured to distribute program guide data, passive guide characteristics, and the passive guide display screen to the user television equipment wherein the passive guide display screen is distributed over a given television channel; and

the interactive television program guide is programmed to overlay a second text display area onto the first text display area of the passive guide display screen, wherein text displayed in the second text display area is based on the passive guide characteristics and corresponds to the video displayed in the video display area.

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18. The system defined in claim 17 wherein the second text display area is an interactive text display area.

19. The system defined in claim 17 wherein the screen generator is further programmed to generate the passive guide characteristics.

20. The system defined in claim 17 wherein the passive guide characteristics includes a playlist.

21. A hybrid passive-interactive television program guide system comprising:

a main facility comprising:

a data source configured to provide program guide data having program listings information;

a video source configured to provide videos;

a transmitter configured to transmit the program guide data to television program guide equipment on which an interactive television program guide is implemented, wherein:

the television program guide equipment comprises:

a receiver configured to receive the program guide data;

a screen generator configured to generate a passive guide display screen in which the videos are displayed;

user television equipment on which the interactive television program guide is at least partially implemented;

distribution equipment configured to distribute program guide data, passive guide characteristics, and the passive guide display screen to the user television equipment, wherein the passive guide display screen is distributed over a given television channel; and

the interactive television program guide is programmed to provide a user with an opportunity to access interactive program listings information for the videos based on the passive guide characteristics.

22. The system defined in claim 21 wherein the interactive television program guide is further programmed to provide a user with an opportunity to access additional information for the videos based on the passive guide characteristics.

23. The system defined in claim 21 wherein the interactive television program guide is further programmed to provide a user with an opportunity to schedule a reminder for a video associated with a program listing.

24. The system defined in claim 21 wherein the interactive television program guide is further programmed to provide a user with an opportunity to record a video associated with a program listing with the television program guide equipment.

25. The system defined in claim 24 wherein the user television equipment comprises a storage device on which the video associated with the program listing is recorded.

26. The system defined in claim 21 wherein the screen generator is further programmed to generate the passive guide characteristics.

27. The system defined in claim 21 wherein the passive guide characteristics includes a playlist.

28. A method for providing a hybrid passive-interactive television program guide, comprising:

providing a passive television program guide with which program listings are displayed on user television equipment over a given television channel; and

providing an interactive television program guide that is implemented on the user television equipment, wherein the interactive television program guide overlays at least a portion of the program listings displayed by the passive television program guide with synchronized program listings.

29. A method for providing a hybrid passive-interactive television program guide, comprising:

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providing a passive television program guide with which content on various subjects is displayed in a display area on user television equipment over a given television channel; and

providing an interactive television program guide that is implemented on the user television equipment, wherein the interactive television program guide overlays at least a portion of the display area with an interactive feature area, wherein the interactive feature area contains a feature that corresponds to the subject of the content that is being displayed in the display area when the portion of the display area is replaced with the interactive feature area.

30. A method for providing a hybrid passive-interactive television program guide, comprising:

providing a passive television program guide on user television equipment over a given television channel; and

simultaneously displaying an interactive advertisement region and at least a portion of the passive television program guide with the user television equipment.

31. The method defined in claim **30** further comprising providing video with the passive television program guide.

32. A method for supplementing a television program guide, comprising:

providing a passive television program guide with which promotional video content for television programs and corresponding textual information on those television programs are displayed on user television equipment over a given channel; and

supplementing the textual information with interactive text using the user television equipment.

33. A method for providing listings for scheduled passive program guide content, comprising:

providing a passive television program guide with which videos on various subjects are scheduled to be displayed on user television equipment over a given television channel; and

displaying an interactive listings screen with the user television equipment, wherein the interactive listings screen contains listings for the scheduled passive program guide videos.

34. A hybrid passive-interactive television program guide system comprising:

means for providing a passive television program guide having program listings information over a given television channel;

means for overlaying the program listings information of the passive television program guide with synchronized interactive television program listings information.

35. The system defined in claim **34** wherein the means for overlaying the program listings information comprises means for replacing overlaying the program listings information with synchronized interactive television program listings information when a user indicates a desire to interact with the program listings information.

36. The system defined in claim **34** wherein:

the passive television program guide further includes at least one video display area that changes size;

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the system further comprises means for displaying the synchronized interactive television program listings information in a listings display area having a size; and the means for displaying the synchronized interactive television program listings information comprises means for resizing the listings display area when the video display area changes size.

37. A hybrid passive-interactive television program guide system comprising:

means for providing a passive television program guide having at least one passive guide feature over a given television channel; and

means for replacing overlaying the passive guide feature with an interactive feature.

38. The system defined in claim **37** wherein the means for overlaying the passive guide feature with an interactive feature, comprises means for overlaying the passive guide feature with an Internet based interactive feature.

39. A hybrid passive-interactive television program guide system comprising:

means for providing a passive television program guide having at least one video over a given television channel; and

means for displaying an advertisement that corresponds to the video with the video.

40. The system defined in claim **39** wherein the means for displaying an advertisement that corresponds to the video with the video comprises means for displaying an interactive advertisement that corresponds to the video with the video.

41. The system defined in claim **39** further comprising means for providing a user with an opportunity to order a program associated with the video.

42. A hybrid passive-interactive television program guide system comprising:

means for providing a passive guide having video and passive text associated with the video over a given television channel; and

means for overlaying the passive text with text associated with the video.

43. The system defined in claim **42** wherein the means for overlaying the passive text comprises means for overlaying the passive text with interactive text associated with the video.

44. A hybrid passive-interactive television program guide system comprising:

means for providing a passive program guide that displays a plurality of videos over a given television channel; and

means for displaying program listings for the videos.

45. The system defined in claim **44** further comprising means for providing a user with an opportunity to access additional information for the videos.

46. The system defined in claim **44** further comprising means for providing a user with an opportunity to schedule a reminder for at least one of the videos.

47. The system defined in claim **44** further comprising means for providing a user with an opportunity to record at least one of the videos.

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US006487722B1

(12) **United States Patent**
Okura et al.

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(45) **Date of Patent:** Nov. 26, 2002

(54) **EPG TRANSMITTING APPARATUS AND METHOD, EPG RECEIVING APPARATUS AND METHOD, EPG TRANSMITTING/RECEIVING SYSTEM AND METHOD, AND PROVIDER**

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(73) **Assignee:** Sony Corporation, Tokyo (JP)

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(52) **U.S. Cl.** 725/40; 725/101; 725/39

(58) **Field of Search** 725/1-8, 37, 40, 725/55, 43, 52, 51, 101, 102, 103, 23, 39, 41

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(57) **ABSTRACT**

The broadcast hour and the title of a program is displayed in an EPG (Electronic Program Guide). If the charge of the program is lower than the other corresponding programs, a symbol "Discount" is also displayed. If the program is the last one of NVOD (Near Video On Demand) programs, a symbol "Last" is also displayed.

19 Claims, 11 Drawing Sheets

CHANNEL	FRAME		BROADCAST HOUR
CH	8:00	9:00	10:00
107 Asahi	PROGRAM TITLE A <i>Live</i>		PROGRAM TITLE A
108 Asahi	PROGRAM TITLE A	PROGRAM TITLE A	
109 Asahi	PROGRAM TITLE A		
110 Asahi	PROGRAM TITLE A		
111 Japan	PROGRAM TITLE B		
112 Japan	PROGRAM TITLE B		
113 Japan	PROGRAM TITLE B		<i>Discount!</i>
114 Japan	PROGRAM TITLE B		<i>Last!</i>
115 STV	PROGRAM TITLE C	PROGRAM TITLE C	PROGRAM <i>Discount!</i> PROGRAM T <i>Discount!</i>

FIG. 1

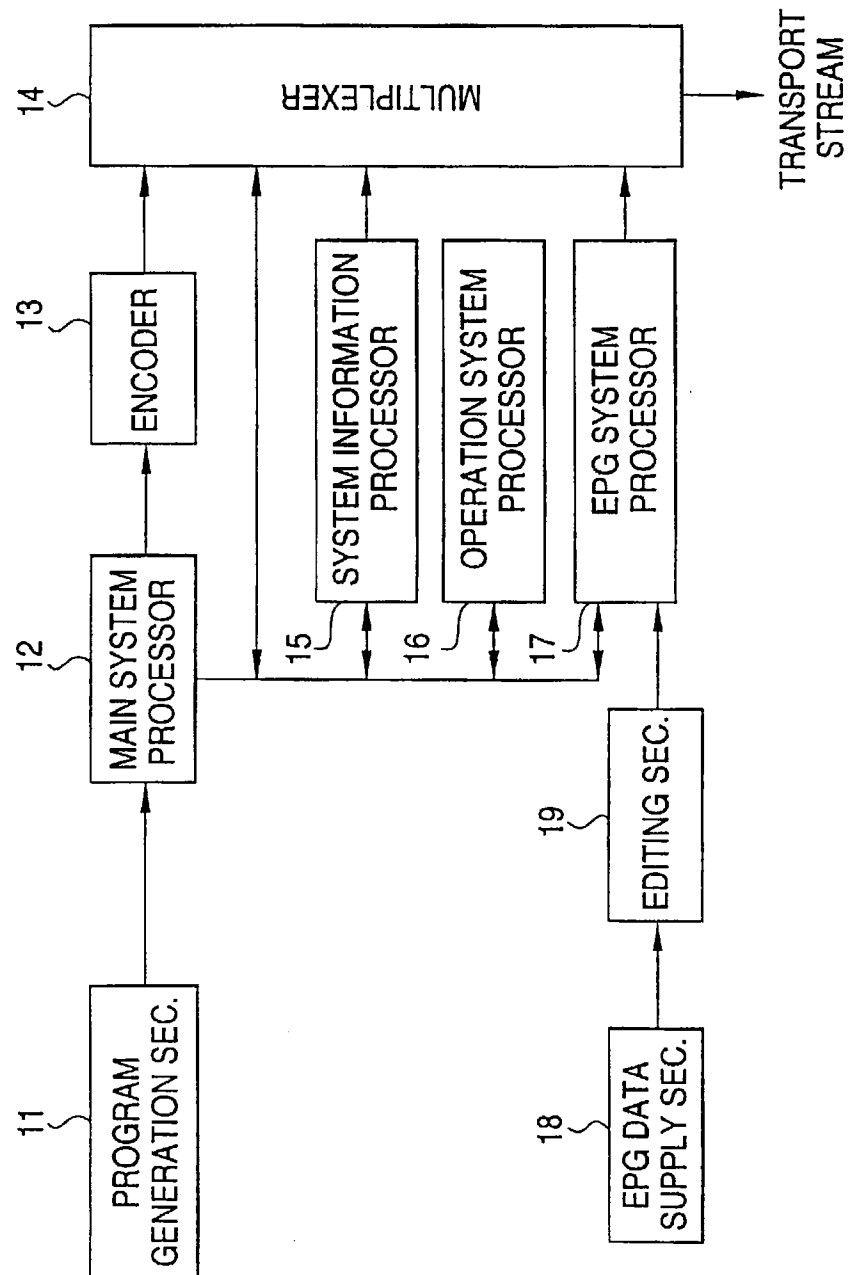


FIG. 2

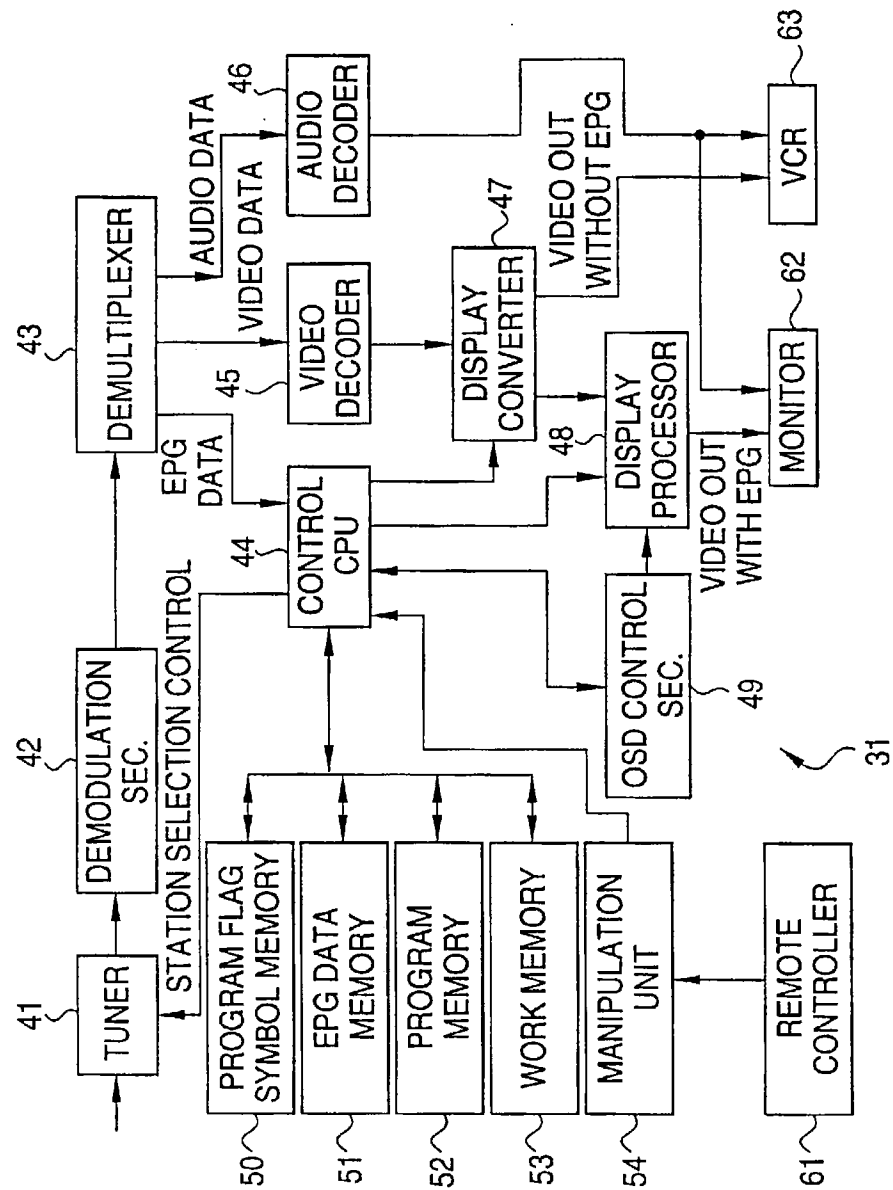


FIG. 3

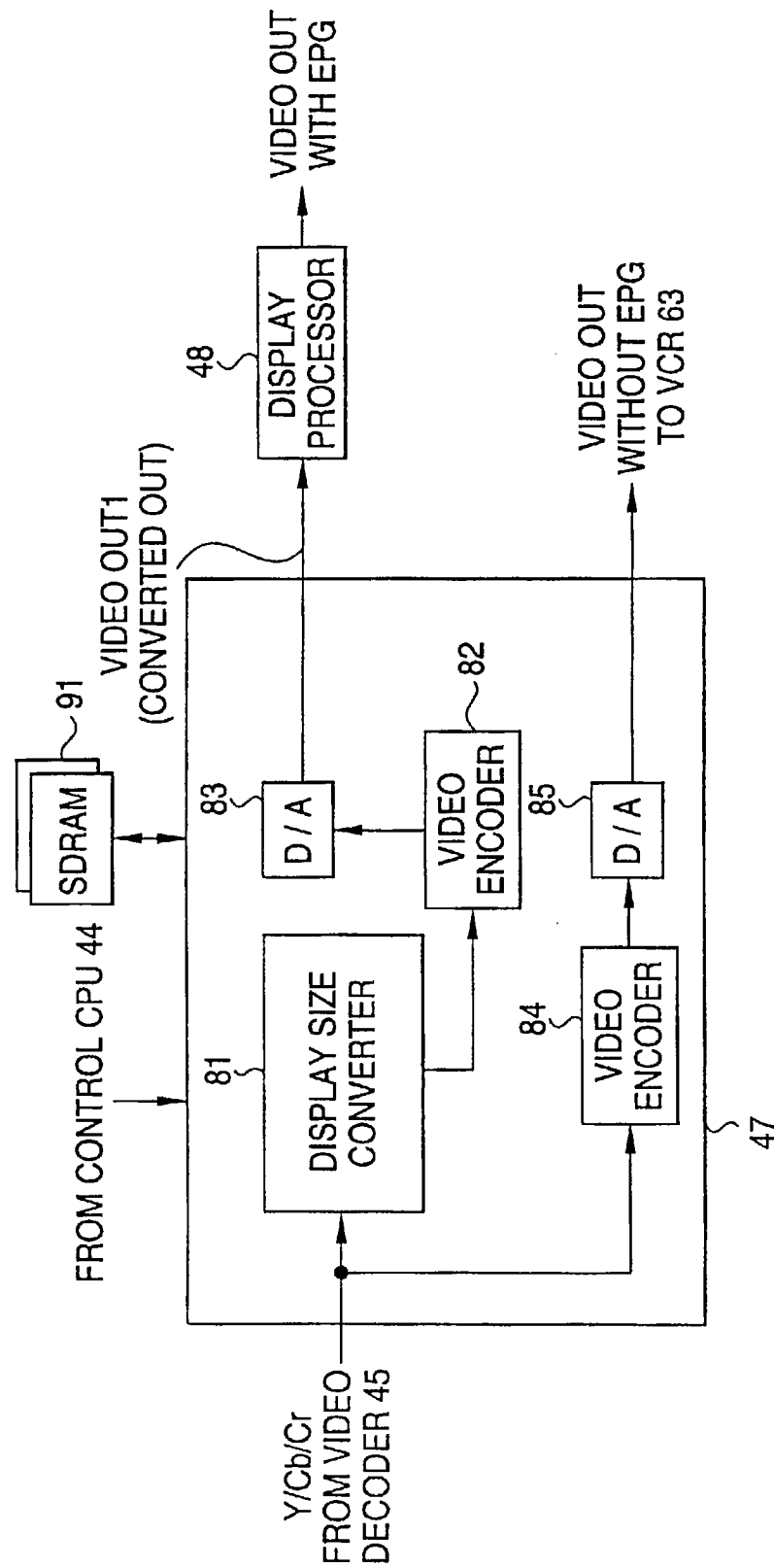


FIG. 4

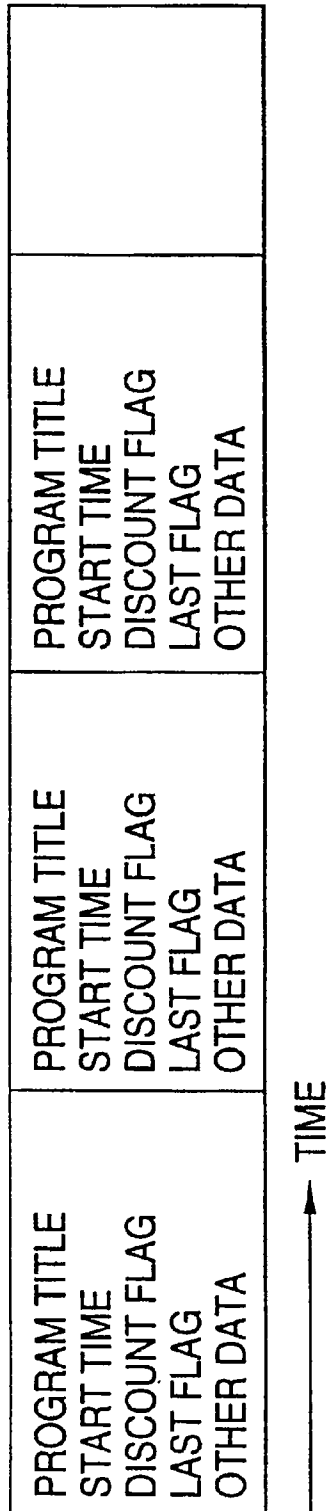


FIG. 5

KIND OF ATTRIBUTE	ATTRIBUTE DATA	EXPLANATION
PROGRAM CONTENT ATTRIBUTE	EXCEPTIONAL PROGRAM	DESIGNATION OF PROGRAM CONTENT ATTRIBUTE EXCEPTIONAL PROGRAM
	EXCLUDED	EXCLUDED PROGRAM
	LIVE	LIVE BROADCAST
	NO-CUT	INDICATES THAT A MOVIE OR THE LIKE WILL BE BROADCAST WITHOUT CUTTING ANY PORTIONS.
	SPECIAL	SPECIAL PROGRAM
	SPECIAL FEATURE	SPECIAL FEATURE PROGRAM
	URGENT	URGENT PROGRAM
	FLASH	NEWS FLASH
	RECOMMENDABLE	RECOMMENDABLE PROGRAM OF STATION WITH RECOMMENDATION GRADE SIGN (" ", " ", " ")
	SERIES	SERIES PROGRAM
PROGRAM OPERATION ATTRIBUTE	NEW PROGRAM	DESIGNATION OF PROGRAM OPERATION ATTRIBUTE MAINLY INDICATES FIRST BROADCAST OF SERIES PROGRAMS.
	REBROADCAST	REBROADCAST
	FINAL PROGRAM	FINAL ONE OF SERIES PROGRAMS
	LAST	INDICATES LAST BROADCAST OF NVOO.
	DISCOUNT	INDICATES THAT A SCHEDULED PPV BROADCAST IS LESS EXPENSIVE THAN USUAL.
PROGRAM MODE ATTRIBUTE		DESIGNATION OF PROGRAM MODE ATTRIBUTE
	HD BROADCAST	HIGH-DEFINITION MODE BROADCAST
	MULTI-ANGLE	MULTI-ANGLE BROADCAST
	DIGITAL SURROUND	DIGITAL SURROUND BROADCAST
	INTERACTIVE	TWO-WAY SERVICE BROADCAST
	DATA BROADCAST	INDICATES THAT THE PROGRAM IS A DATA BROADCAST PROGRAM.
	AUDIO BROADCAST	INDICATES THAT THE PROGRAM WILL BE BROADCAST ONLY BY AUDIO.
	MONOCHROME	MONOCHROME BROADCAST
	STEREO	STEREO BROADCAST
	CAPTION	INDICATES THAT THE PROGRAM IS ASSOCIATED WITH CAPTIONS.
	WIDE	WIDE BROADCAST
	BILINGUAL	BILINGUAL BROADCAST
	MULTI-LINGUAL	MULTI-LINGUAL BROADCAST
	DUAL AUDIO	DUAL AUDIO BROADCAST
	SIGN LANGUAGE	BROADCAST WITH SIGN LANGUAGE
	NON-SCRAMBLED	NON-SCRAMBLED BROADCAST
	SCRAMBLED	SCRAMBLED BROADCAST
TEXT ATTRIBUTE		DESIGNATION OF TEXT ATTRIBUTE OF EPG PROGRAM TITLE
	TEXT COLOR	COLOR DESIGNATION OF TITLE TEXT
	UNDERLINE	UNDERLINE DESIGNATION OF TITLE TEXT
	ITALIC	ITALIC DESIGNATION OF TITLE TEXT
	BLINK	BLINK DESIGNATION OF TITLE TEXT
	BACKGROUND COLOR	BACKGROUND COLOR DESIGNATION OF TITLE TEXT
	BOLD	BOLD DESIGNATION OF TITLE TEXT

FIG. 6

CHANNEL		FRAME		BROADCAST HOUR	
CH		8:00	9:00	10:00	
107 Asahi	PROGRAM TITLE A	Live	PROGRAM TITLE A		
108 Asahi	PROGRAM TITLE A		PROGRAM TITLE A		PROGRAM TITLE A
109 Asahi			PROGRAM TITLE A		
110 Asahi			PROGRAM TITLE A		
111 Japan	PROGRAM TITLE B				
112 Japan	PROGRAM TITLE B				
113 Japan	PROGRAM TITLE B				Discount!
114 Japan			PROGRAM TITLE B		Last!
115 STV	PROGRAM TITLE C	PROGRAM TITLE C	PROGRAM TITLE C	PROGRAM TITLE C	Discount!
					Discount!

FIG. 7

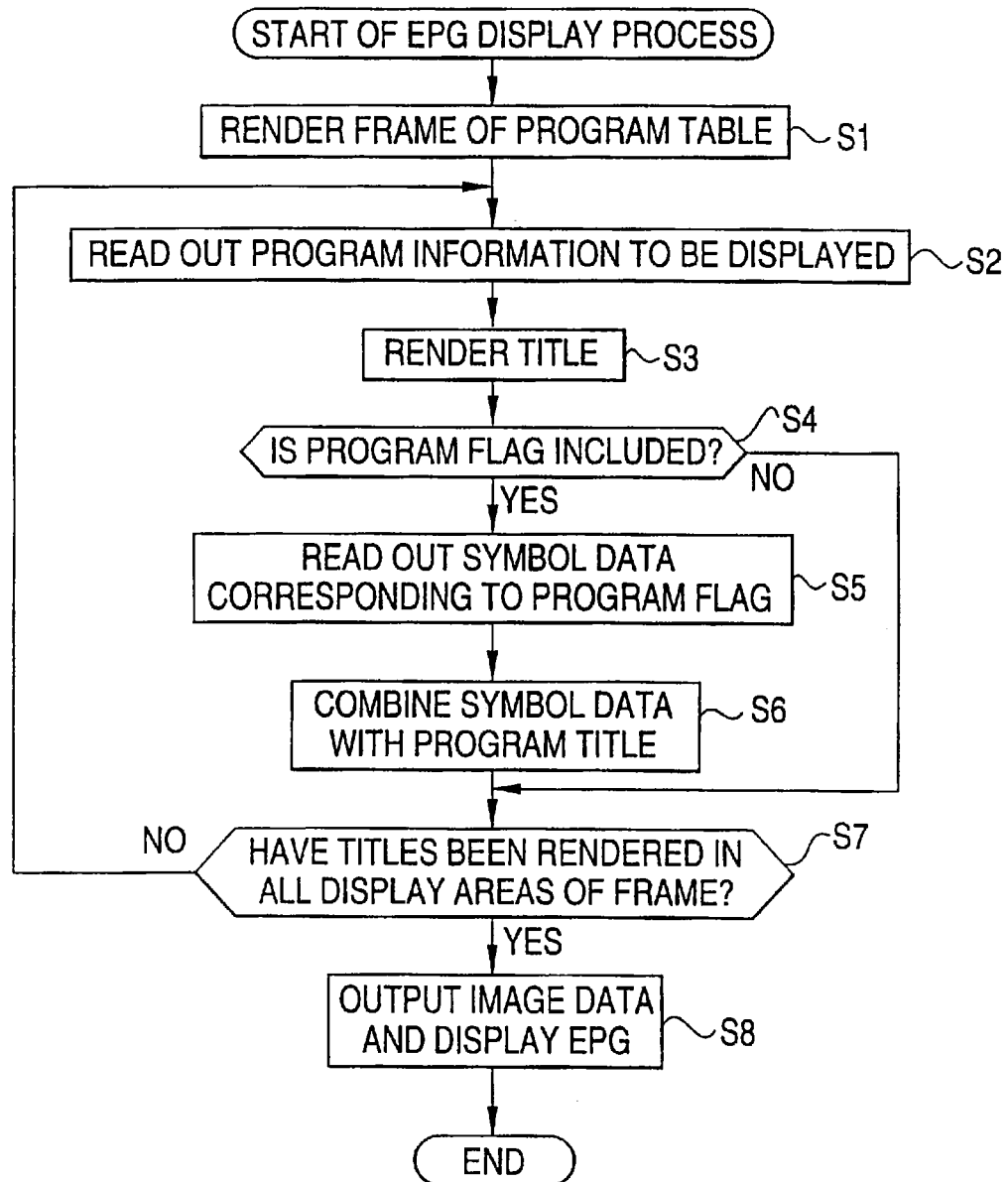


FIG. 8

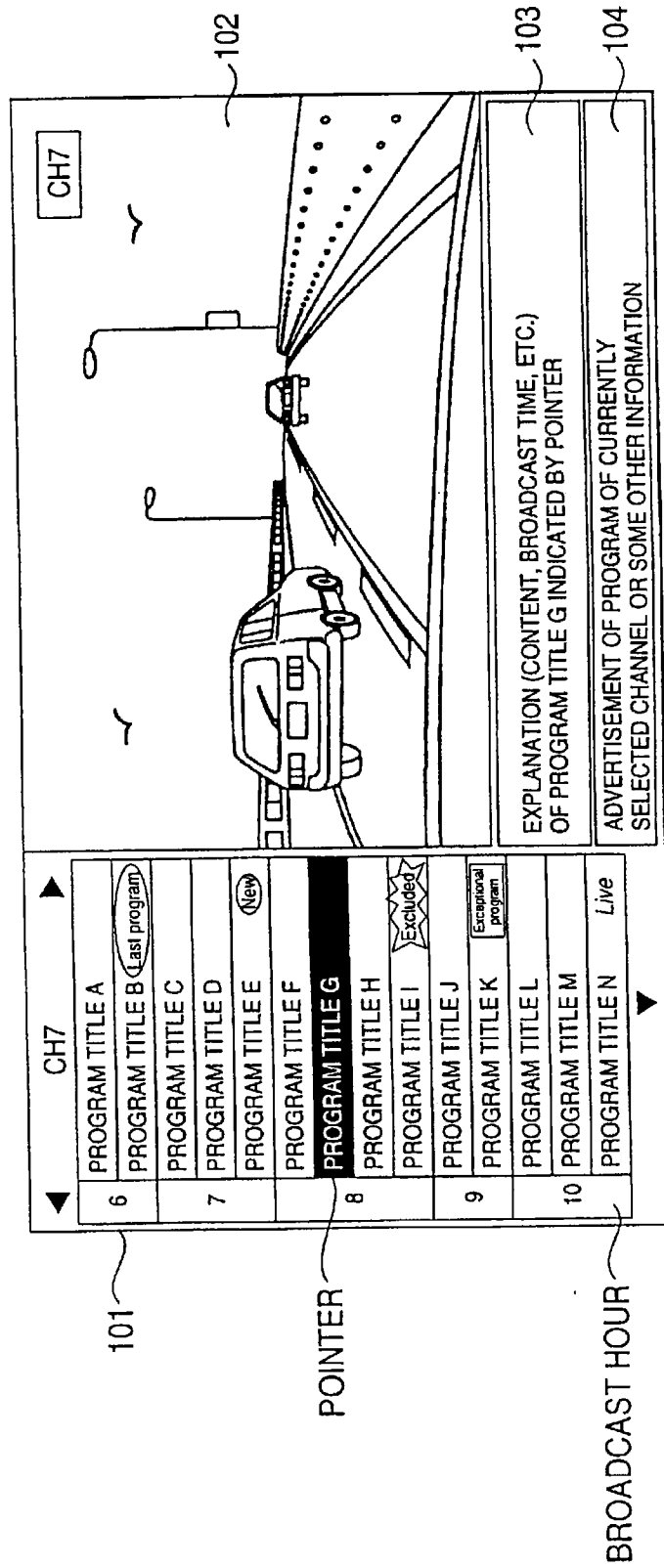


FIG. 9

CHANNEL		FRAME		BROADCAST HOUR	
CH	8:00	9:00	10:00		
107 Asahi	PROGRAM TITLE A		PROGRAM TITLE A		
108 Asahi		PROGRAM TITLE A	PROGRAM TITLE A		
109 Asahi			PROGRAM TITLE A		
110 Asahi			PROGRAM TITLE A		
111 Japan	PROGRAM TITLE B				
112 Japan		PROGRAM TITLE B			
113 Japan		PROGRAM TITLE B			
114 Japan		PROGRAM TITLE B			
115 STV	PROGRAM TITLE C	PROGRAM TITLE C	PROGRAM TITLE C	PROGRAM TITLE C	PROGRAM TITLE C

FIG. 10

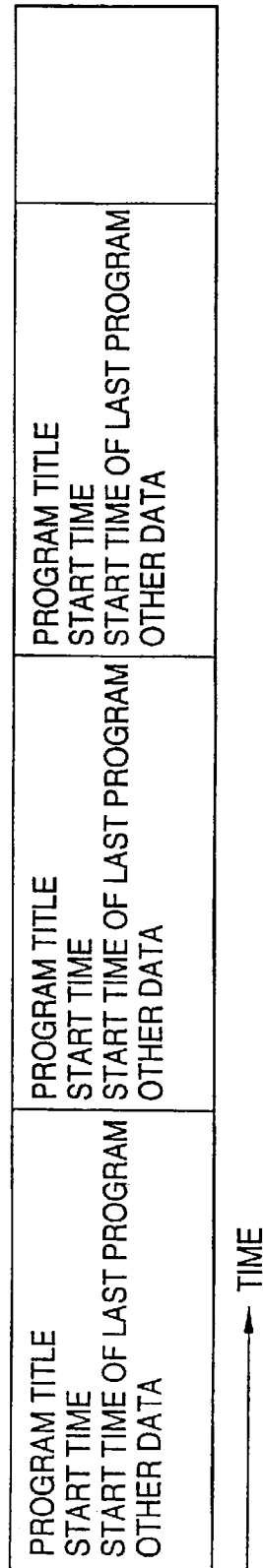
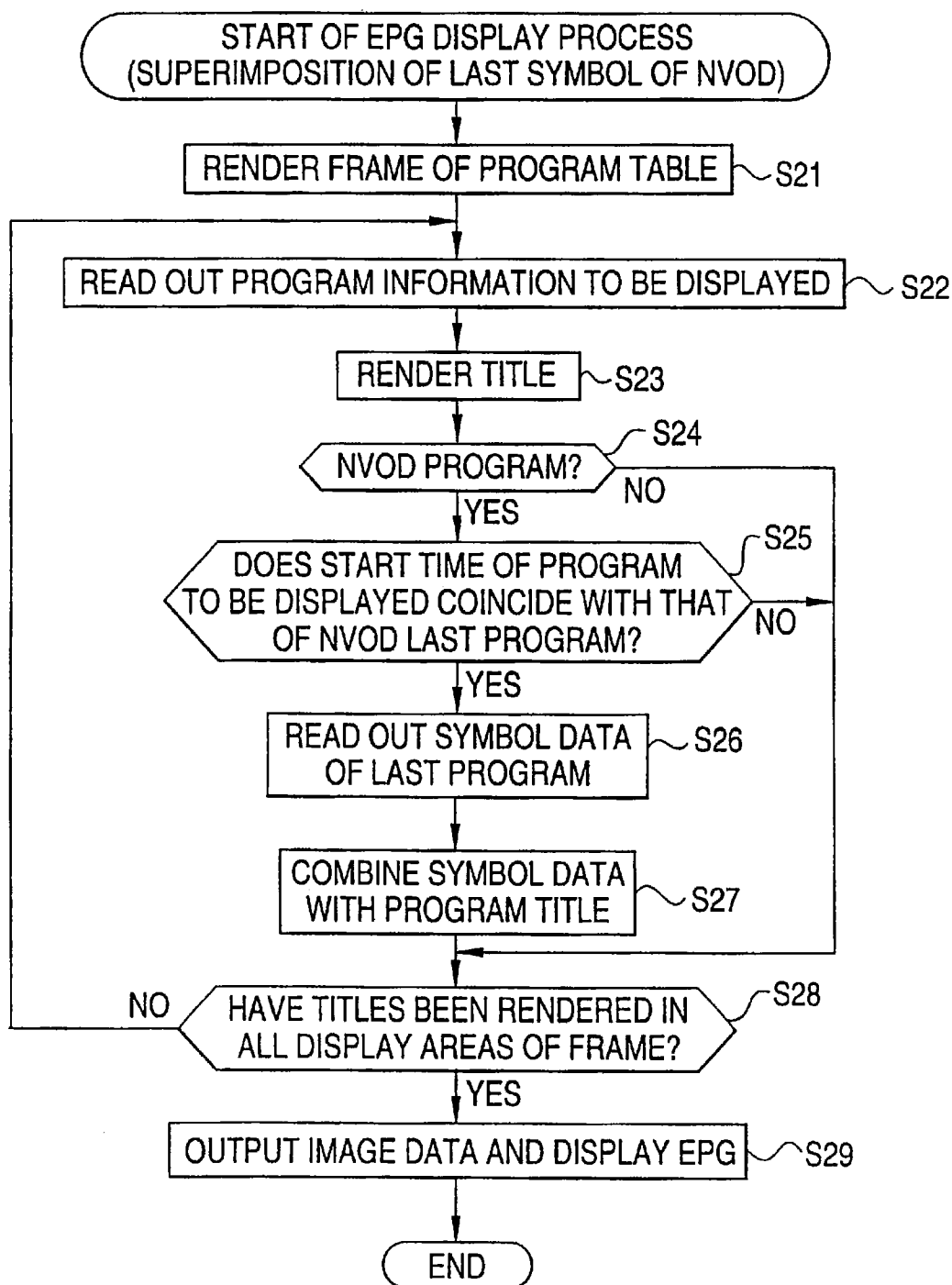


FIG. 11



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EPG TRANSMITTING APPARATUS AND METHOD, EPG RECEIVING APPARATUS AND METHOD, EPG TRANSMITTING/RECEIVING SYSTEM AND METHOD, AND PROVIDER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an EPG (Electronic Program Guide) transmitting apparatus and method, an EPG receiving apparatus and method, an EPG transmitting/receiving system and method, and a provider. In particular, the invention relates to an EPG transmitting apparatus and method, an EPG receiving apparatus and method, an EPG transmitting/receiving system and method, and a provider which allow viewers to recognize the feature of a NVD (Near Video On Demand) program easily and reliably and hence can have that program viewed by more viewers.

2. Description of the Related Art

In recent years, also in Japan, digital satellite broadcasting has started and it has become possible to provide programs on as many as 100 channels or more. By virtue of the increase in the number of channels, what is called NVD (near video on demand) has also been realized in which, for example, the same program is broadcast six times with 10 minutes' delays in broadcast hours. This enables viewers to watch a desired program from its start in which they can select a watching start time in a one-hour period.

As the number of channels increases as mentioned above, it becomes more inconvenient for a viewer to select a desired program properly from a number of programs. In view of this, EPG (electronic program guide) data is transmitted separately from information of primary programs so that viewers can select a desired program based on the EPG.

To enable selection of a desired program from many programs, it has been proposed to use EPG data so as to display, for example, a mark that indicates the category of each program. Looking at a category mark, viewers can recognize relatively easily what category (e.g., movies, sports, or news) the program belongs to.

However, the conventional digital satellite broadcast has a problem that it is impossible to provide viewers quickly and reliably with information that characterizes each program, though as described above information allowing discrimination between programs on a group-by-group basis is now transmitted.

For example, the NVD has a problem that even if the same program is broadcast six times, viewers cannot judge quickly and reliably which is the last version, in other words, the start time of a version of the program that viewers are required to watch at the latest if they wish to see the program.

SUMMARY OF THE INVENTION

The present invention has been made in view of the above circumstances in the art, and an object of the invention is therefore to enable viewers to intuitively recognize information that characterizes each program in a quick and reliable manner and to provide viewers with the feature of each program, to thereby promote viewing of programs.

An EPG transmitting apparatus according to a first aspect of the invention comprises generating means for generating an EPG that represents a transmission schedule of programs to be transmitted; adding means for generating additional

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information to be used to display, so that the additional information is superimposed on the EPG, feature recognition information for allowing a viewer to intuitively recognize a feature of a particular one of the programs that differentiates the particular program from other ones of the programs, and for adding the feature recognition information to the EPG; and transmitting means for transmitting the EPG to which the additional information has been added.

An EPG transmitting method according to the first aspect of the invention comprises a generating step of generating an EPG that represents a transmission schedule of programs to be transmitted; an adding step of generating additional information to be used to display, so that the additional information is superimposed on the EPG, feature recognition information for allowing a viewer to intuitively recognize a feature of a particular one of the programs that differentiates the particular program from other ones of the programs, and for adding the feature recognition information to the EPG; and a transmitting step of transmitting the EPG to which the additional information has been added.

A provider according to the first aspect of the invention provides a computer program comprising a generating step of generating an EPG that represents a transmission schedule of programs to be transmitted; an adding step of generating additional information to be used to display, so that the additional information is superimposed on the EPG, feature recognition information for allowing a viewer to intuitively recognize a feature of a particular one of the programs that differentiates the particular program from other ones of the programs, and for adding the feature recognition information to the EPG; and a transmitting step of transmitting the EPG to which the additional information has been added.

An EPG receiving apparatus according to a second aspect of the invention comprises receiving means for receiving an EPG to which additional information to be used to display, so that the additional information is superimposed on the EPG, feature recognition information for allowing a viewer to intuitively recognize a feature of a particular one of programs that differentiates the particular program from other ones of the programs is added; extracting means for extracting the additional information from the EPG that has been received by the receiving means; storing means for storing information to be used for displaying the feature recognition information; and display control means for reading out the information stored in the storing means and corresponding to the additional information that has been extracted by the extracting means, and displaying the feature recognition information.

An EPG receiving method according to the second aspect of the invention comprises a receiving step of receiving an EPG to which additional information to be used to display, so that the additional information is superimposed on the EPG, feature recognition information for allowing a viewer to intuitively recognize a feature of a particular one of programs that differentiates the particular program from other ones of the programs is added; an extracting step of extracting the additional information from the EPG that has been received by the receiving step; a storing step of storing information to be used for displaying the feature recognition information; and a display control step of reading out the information stored by the storing step and corresponding to the additional information that has been extracted by the extracting step, and displaying the feature recognition information.

A provider according to the second aspect of the invention provides a computer program comprising a receiving step of

receiving an EPG to which additional information to be used to display, so that the additional information is superimposed on the EPG, feature recognition information for allowing a viewer to intuitively recognize a feature of a particular one of programs that differentiates the particular program from other ones of the programs is added; an extracting step of extracting the additional information from the EPG that has been received by the receiving step; a storing step of storing information to be used for displaying the feature recognition information; and a display control step of reading out the information stored by the storing step and corresponding to the additional information that has been extracted by the extracting step, and displaying the feature recognition information.

An EPG transmitting and receiving system according to a third aspect of the invention comprises an EPG transmitting apparatus for transmitting information, comprising generating means for generating an EPG that represents a transmission schedule of programs to be transmitted; adding means for generating additional information to be used to display, so that the additional information is superimposed on the EPG, feature recognition information for allowing a viewer to intuitively recognize a feature of a particular one of the programs that differentiates the particular program from other ones of the programs, and for adding the feature recognition information to the EPG; and transmitting means for transmitting the EPG to which the additional information has been added; and an EPG receiving apparatus for receiving the information transmitted from the EPG transmitting apparatus, comprising receiving means for receiving the EPG transmitted from the transmitting apparatus; extracting means for extracting the additional information from the EPG received by the receiving means; storing means for storing information to be used for displaying the feature recognition information; and display control means for reading out the information stored in the storing means and corresponding to the additional information that has been extracted by the extracting means, and displaying the feature recognition information.

An EPG transmitting and receiving method according to the third aspect of the invention in an EPG transmitting and receiving apparatus including an EPG transmitting apparatus for transmitting information and an EPG receiving apparatus for receiving the information transmitted from the EPG transmitting apparatus, comprises, in the EPG transmitting apparatus, a generating step of generating an EPG that represents a transmission schedule of programs to be transmitted; an adding step of generating additional information to be used to display, so that the additional information is superimposed on the EPG, feature recognition information for allowing a viewer to intuitively recognize a feature of a particular one of the programs that differentiates the particular program from other ones of the programs, and for adding the feature recognition information to the EPG; and a transmitting step of transmitting the EPG to which the additional information has been added, and the method further comprises, in the EPG receiving apparatus, a receiving step of receiving the EPG transmitted by the transmitting step; an extracting step of extracting the additional information from the EPG received by the receiving step; a storing step of storing information to be used for displaying the feature recognition information; and a display control step of reading out the information stored by the storing step and corresponding to the additional information that has been extracted by the extracting step, and displaying the feature recognition information.

A provider according to the third aspect of the invention provides a computer program to be used in an EPG trans-

mitting and receiving apparatus including an EPG transmitting apparatus for transmitting information and an EPG receiving apparatus for receiving the information transmitted from the EPG transmitting apparatus, a part of the computer program for the EPG transmitting apparatus comprising a generating step of generating an EPG that represents a transmission schedule of programs to be transmitted; an adding step of generating additional information to be used to display, so that the additional information is superimposed on the EPG, feature recognition information for allowing a viewer to intuitively recognize a feature of a particular one of the programs that differentiates the particular program from other ones of the programs, and for adding the feature recognition information to the EPG; and a transmitting step of transmitting the EPG to which the additional information has been added, a part of the computer program for the EPG receiving apparatus comprising a receiving step of receiving the EPG transmitted by the transmitting step; an extracting step of extracting the additional information from the EPG received by the receiving step; a storing step of storing information to be used for displaying the feature recognition information; and a display control step of reading out the information stored by the storing step and corresponding to the additional information that has been extracted by the extracting step, and displaying the feature recognition information.

An EPG receiving apparatus according to a fourth aspect of the invention comprises receiving means for receiving an EPG that represents a schedule of programs to be transmitted; detecting means for detecting whether a particular one of the programs has a feature that differentiates the particular program from other ones of the programs; and display control means for displaying, in accordance with a recognition result of the detecting means, feature recognition information for allowing a viewer to intuitively recognize that the particular program has the feature that differentiates the particular program from the other ones of the programs so that the feature recognition information is superimposed on the EPG.

An EPG receiving method according to the fourth aspect of the invention comprises a receiving step of receiving an EPG that represents a schedule of programs to be transmitted; a detecting step of detecting whether a particular one of the programs has a feature that differentiates the particular program from other ones of the programs; and a display control step of displaying, in accordance with a recognition result of the detecting step, feature recognition information for allowing a viewer to intuitively recognize that the particular program has the feature that differentiates the particular program from the other ones of the programs so that the feature recognition information is superimposed on the EPG.

A provider according to the fourth aspect of the invention provides a computer program comprising a receiving step of receiving an EPG that represents a schedule of programs to be transmitted; a detecting step of detecting whether a particular one of the programs has a feature that differentiates the particular program from other ones of the programs; and a display control step of displaying, in accordance with a recognition result of the detecting step, feature recognition information for allowing a viewer to intuitively recognize that the particular program has the feature that differentiates the particular program from the other ones of the programs so that the feature recognition information is superimposed on the EPG.

In the EPG transmitting apparatus, the EPG transmitting method, and the provider according to the first aspect of the

invention, additional information to be used for displaying feature recognition information so that it is superimposed on an EPG is transmitted.

In the EPG receiving apparatus, the EPG receiving method, and the provider according to the second aspect of the invention, feature recognition information corresponding to received additional information is displayed.

In the EPG transmitting and receiving system, the EPG transmitting and receiving method, and the provider according to the third aspect of the invention, additional information is transmitted from an EPG transmitting apparatus and feature recognition information corresponding to the received additional information is displayed in the EPG receiving apparatus.

In the EPG receiving apparatus, the EPG receiving method, and the provider according to the fourth aspect of the invention, whether a particular program has a feature that differentiates it from other programs is detected and feature recognition information is displayed so as to be superimposed on an EPG in accordance with a detection result.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram showing an example configuration of a transmitting apparatus according to the present invention;

FIG. 2 is a block diagram showing an example configuration of a receiving apparatus according to the invention;

FIG. 3 is a block diagram showing an example configuration of the display converter shown in FIG. 2;

FIG. 4 shows examples of program flags;

FIG. 5 shows contents to be transmitted as program flags;

FIG. 6 is an illustration showing a display example on the monitor shown in FIG. 2;

FIG. 7 is a flowchart showing an EPG display process;

FIG. 8 is an illustration showing another display example on the monitor shown in FIG. 2;

FIG. 9 is an illustration showing a further display example on the monitor shown in FIG. 2;

FIG. 10 shows an example of additional information; and

FIG. 11 is a flowchart showing another EPG display process.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiments of the present invention will be described below. Before doing so, to clarify a corresponding relationship between each means of the invention described in the claims and components of the following embodiments, the features of the invention will be described below in such a manner that each means is followed, in parentheses, by a corresponding component (just an example) of the embodiments. However, naturally, the following statement does not mean that each means is limited to the component following it.

The EPG transmitting apparatus according to the first aspect of the invention comprises generating means (e.g., an EPG data supply section 18 shown in FIG. 1) for generating an EPG that represents a transmission schedule of programs to be transmitted; adding means (e.g., an editing section 19 shown in FIG. 1) for generating additional information (e.g., a program flag generated by the editing section 19 shown in FIG. 1) to be used to display, so that the additional information is superimposed on the EPG, feature recognition information (e.g., a symbol "Last" shown in FIG. 6) for

allowing a viewer to intuitively recognize a feature of a particular one of the programs that differentiates the particular program from other ones of the programs, and for adding the feature recognition information to the EPG; and transmitting means (e.g., a multiplexer 14 shown in FIG. 1) for transmitting the EPG to which the additional information has been added.

The EPG receiving apparatus according to the second aspect of the invention comprises receiving means (e.g., a tuner 41 shown in FIG. 2) for receiving an EPG to which additional information to be used to display, so that the additional information is superimposed on the EPG, feature recognition information for allowing a viewer to intuitively recognize a feature of a particular one of programs that differentiates the particular program from other ones of the programs is added; extracting means (e.g., a control CPU 44 shown in FIG. 2) for extracting the additional information from the EPG that has been received by the receiving means; storing means (e.g., a program flag symbol memory 50 shown in FIG. 2) for storing information to be used for displaying the feature recognition information; and display control means (e.g., an OSD control section 49 shown in FIG. 2) for reading out the information stored in the storing means and corresponding to the additional information that has been extracted by the extracting means, and displaying the feature recognition information.

The EPG transmitting and receiving system according to the third aspect of the invention comprises an EPG transmitting apparatus for transmitting information, comprising generating means (e.g., the EPG data supply section 18 shown in FIG. 1) for generating an EPG that represents a transmission schedule of programs to be transmitted; adding means (e.g., the editing section 19 shown in FIG. 1) for generating additional information to be used to display, so that the additional information is superimposed on the EPG, feature recognition information for allowing a viewer to intuitively recognize a feature of a particular one of the programs that differentiates the particular program from other ones of the programs, and for adding the feature recognition information to the EPG; and transmitting means (e.g., the multiplexer 14 shown in FIG. 1) for transmitting the EPG to which the additional information has been added; and an EPG receiving apparatus for receiving the information transmitted from the EPG transmitting apparatus, comprising receiving means (e.g., the tuner 41 shown in FIG. 2) for receiving the EPG transmitted from the transmitting apparatus; extracting means (e.g., the control CPU 44 shown in FIG. 2) for extracting the additional information from the EPG received by the receiving means; storing means (e.g., the program flag symbol memory 50 shown in FIG. 2) for storing information to be used for displaying the feature recognition information; and display control means (e.g., the OSD control section 49 shown in FIG. 2) for reading out the information stored in the storing means and corresponding to the additional information that has been extracted by the extracting means, and displaying the feature recognition information.

The EPG receiving apparatus according to the fourth aspect of the invention comprises receiving means (e.g., the tuner 41 shown in FIG. 2) for receiving an EPG that represents a schedule of programs to be transmitted; detecting means (e.g., the control CPU 44 shown in FIG. 2) for detecting whether a particular one of the programs has a feature that differentiates the particular program from other ones of the programs; and display control means (e.g., the OSD control section 49 shown in FIG. 2) for displaying, in accordance with a recognition result of the detecting means,

feature recognition information for allowing a viewer to intuitively recognize that the particular program has the feature that differentiates the particular program from the other ones of the programs so that the feature recognition information is superimposed on the EPG.

The EPG receiving apparatus according to the fourth aspect of the invention may further comprise storing means (e.g., the program flag symbol memory 50 shown in FIG. 2) for storing the feature recognition information.

FIG. 1 shows an example configuration of a transmitting apparatus 1 that constitutes a transmitting/receiving system according to the invention. In the transmitting apparatus 1, a program generation section 11 generates data (audio data and video data) of a program to be broadcast. A main system processor 12 supplies an encoder 13 with program data that is supplied from the program generation section 11 and makes the encoder 13 encode the program data. Further, the main system processor 12 generates a reference clock signal, time information, etc. and supplies those to a system information processor 15, an operation system processor 16, an EPG system processor 17, a multiplexer 14, etc. The encoder 13 encodes the program data that is supplied from the program generation section 11 via the main system processor 12 according to, for example, the MPEG scheme and outputs encoded data to the multiplexer 14.

The system information processor 15 generates system information and controls a multiplexing process of the multiplexer 14. The operation system processor 16 processes an instruction corresponding to an input from a keyboard, a mouse (both not shown), or the like and outputs a processing result to the main system processor 12 when necessary.

An EPG data supply section 18 generates EPG data and outputs it to an editing section 19. Where an individual program has a feature and it is desired to display an EPG of the program with feature recognition information added to it, the editing section 19 generates a program flag indicating that situation and inserts it in the EPG data. The EPG system processor 17 processes the EPG data that is supplied from the editing section 19, in synchronism with a signal that is supplied from the main system processor 12, and outputs processed data to the multiplexer 14. The multiplexer 14 combines the program data (audio data and video data) that is supplied from the encoder 13 and the EPG data that is supplied from the EPG system processor 17 into a transport stream, and transmits it to a satellite (not shown).

FIG. 2 shows an example configuration of a receiving apparatus 31 for receiving data that is transmitted from the transmitting apparatus 1 of FIG. 1 via a satellite. The receiving apparatus 31 receives, with a tuner 41, radio waves that are transmitted from the satellite and outputs a reception signal to a demodulation section 42. The demodulation section 42 demodulates the signal supplied from the tuner 41 and outputs a demodulation signal to a demultiplexer 43. The demultiplexer 43 extracts not only audio data and video data that constitute program data but also EPG data from the data that is input from the demodulation section 42. The demultiplexer 43 supplies the audio data to an audio decoder 46, the video data to a video decoder 45, and the EPG data to a control CPU 44.

The audio decoder 46 decodes the input audio data and outputs decoded data to, for example, a VCR (video cassette recorder) 63 and a monitor 62 that are connected to the receiving apparatus 31. The video decoder 45 decodes the input video data and outputs decoded data to a display converter 47. The display converter 47 reduces the size of a

picture that is based on the video data supplied from the video decoder 45 to a prescribed size in accordance with a control of the control CPU 44, and outputs resulting data to a display processor 48. The display converter 47 also outputs a video data signal that has not been subjected to picture size reduction to the VCR 63.

Controlled by the control CPU 44, an OSD control section 49 generates OSD (on-screen display) data to be superimposed on video data and outputs it to the display processor 48. Controlled by the control CPU 44, the display processor 48 combines the OSD data that is supplied from the OSD control section 49 with the video data that is supplied from the display converter 47, and outputs resulting data to the monitor 62.

A program flag symbol memory 50 stores data of symbols (feature recognition information) to be superimposed on an EPG so that they correspond to respective program flags. An EPG data memory 51 stores the EPG data that has been supplied from the demultiplexer 43 to the control CPU 44. A program memory 52 stores programs that are necessary for the control CPU 44 to execute various processes. A work memory 53 stores, when necessary, data, programs, etc. that are necessary for the control CPU 44 to execute various processes. A manipulation unit 54 captures an infrared signal that is input from a remote controller 61 and an input from buttons, switches, and the like (not shown) that are provided on the main body of the receiving apparatus 31, and outputs a resulting detection signal to the control CPU 44.

FIG. 3 shows an example configuration of the display converter 47. A display size converter 81 reduces the size of one picture that is formed by a luminance signal Y and color difference signals Cb (B-Y) and Cr (R-Y) that are supplied from the video decoder 45 to a prescribed size in accordance with an instruction that is supplied from the control CPU 44, and outputs resulting data to a video encoder 82. The video encoder 82 converts the video data that is input from the display size converter 81 to video data of, for example, the NTSC (National Television Systems Committee) scheme and outputs it to a D/A converter 83. The D/A converter 83 D/A-converts the input video data and outputs resulting data to the display processor 48. The display processor 48 processes the input video data, combines it with symbols (figures) etc. corresponding to the EPG that are supplied from the OSD control section 49 as described above, and outputs resulting data to the monitor 62.

On the other hand, the video data that is input from the video decoder 45 is converted to video data of the NTSC scheme by a video encoder 84, converted to an analog signal by a D/A converter 85, and then supplied to the VCR 63. The video signal supplied to the VCR 63 does not include the EPG because it is not processed by the display processor 48.

An SDRAM 91 is also connected to the display converter 47. The SDRAM 91 is a memory for temporarily storing picture data when the display size converter 81 changes the display size.

Next, the operations of the above apparatuses will be described. Program data that has been generated by the program generation section 11 is supplied to the encoder 13 via the main system processor 12 and encoded there. On the other hand, the EPG data supply section 18 generates EPG data of broadcast-scheduled programs of two weeks, for example, and outputs the generated EPG data to the editing section 19. The editing section 19 executes an editing process on the EPG data. Where each program has a feature that differentiates it from other programs, the editing section 19 adds, to the EPG data, a program flag that is necessary to

superimpose, on the EPG, feature recognition information for allowing viewers to recognize the feature.

FIG. 4 shows examples of program flags. As shown in FIG. 4, when supplied with EPG data including program titles of respective programs from the EPG data supply section 18, broadcast start hours, and other data from the EPG data supply section 18, the editing section 19 adds, to the EPG data, a discount flag for displaying feature recognition information (i.e., a mark "Discount" described later) indicating that the charge of the program is set lower than the other programs so that the feature recognition information is superimposed on the EPG, a last flag for displaying feature recognition information (i.e., a mark "Last" described later) indicating that the program is the last one of NVDOD programs so that the feature recognition information is superimposed on the EPG, and other flags.

The format of FIG. 4 is prescribed by DVB (digital video broadcasting)_SI.

The EPG system processor 17 processes the EPG data that is supplied from the encoder 13 and the EPG data that is supplied from the EPG system processor 17, combines packetized data into a transport stream, and transmits it to a multiplexer 14.

The multiplexer 14 packetizes each of the program data that is supplied from the encoder 13 and the EPG data that is supplied from the EPG system processor 17, combines packetized data into a transport stream, and transmits it to a satellite.

In addition to the discount flag and the last flag, as shown in FIG. 5, the editing section 19 may add an exceptional program flag indicating that the program is an exceptional one, an exclusion flag indicating that the program is an excluded one, a live flag indicating that the program is live, a final program flag indicating that the program is the final one of series programs, and other flags.

In the receiving apparatus 31, the control CPU 44 controls the tuner 41 in accordance with an instruction supplied from the remote controller 61 or the manipulation unit 54, to have it receive a signal coming from a prescribed transponder of the satellite. The demodulation section 42 demodulates a signal that is output from the tuner 41 and outputs a demodulation signal to the demultiplexer 43. The demultiplexer 43 extracts audio data, video data, and EPG data from the data that is supplied from the demodulation section 42, and outputs those data to the audio decoder 46, the video decoder 45, and the control CPU 44, respectively.

The audio decoder 46 decodes the received audio data packets and outputs decoded data to the VCR 63 and the monitor 62. The video decoder 45 decodes the received video data packets and outputs decoded data to the display converter 47.

The display size converter 81 of the display converter 47 stores the received video data in the SDRAM 91 and executes a process of changing its display size to a size corresponding to an instruction that is supplied from the control CPU 44. Video data whose size has been converted to the prescribed size is converted to video data of the NTSC scheme by the video encoder 82, D/A-converted by the D/A converter 83, and then input to the display processor 48.

The video encoder 84 of the display converter 47 encodes the video data that has been supplied from the video encoder 45 into video data of the NTSC scheme without changing its display size, and outputs it to the D/A converter 85. The D/A converter 85 D/A converts the received video data and outputs converted video data to the VCR 63.

The control CPU 44 stores the EPG data that is supplied from the demultiplexer 43 in the EPG data memory 51.

When receiving a prescribed instruction from the remote controller 61 or the manipulation unit 54, the control CPU 44 reads out the EPG data that is stored in the EPG data memory 51 and outputs the read-out data to the OSD control section 49. The OSD control section 49 converts the received EPG data to picture data and outputs it to the display processor 48. The display processor 48 outputs the picture data that is supplied from the OSD control section 49 to the monitor 62 singly or after superimposing it on the video picture data that is supplied from the display converter 47. In this manner, an EPG picture is displayed on the monitor 62.

In displaying the EPG on the monitor 62, the control CPU 44 judges whether the EPG data includes a program flag. If a program flag is included, the control CPU 44 reads out the corresponding symbol data from the program flag symbol memory 50 and outputs it to the OSD control section 49. The OSD control section 49 generates picture data of the symbol, superimposes it on the EPG picture data, and outputs resulting picture data to the monitor 62 via the display processor 48 to display it.

As a result, an EPG shown in FIG. 6, for example, is displayed on the monitor 62. In this example, the display shows that program A is NVDOD-broadcast on channels 107-110. A symbol "Live" indicates that, in particular, the program A that will be broadcast from 8 hours on channel 107 is a live program.

Program B is NVDOD-broadcast four times on channels 111-114. A symbol "Discount" that is given to the specific program B that will be broadcast second last on channel 113 indicates that charge of this program is set lower than the other versions of program B. Further, the specific program B to be broadcast on channel 114 is given a symbol "Last" indicating that this is the last one of the NVDOD programs.

As shown in the display example of FIG. 6, program C is NVDOD-broadcast repeatedly on channel 115. The last two versions of program C is given a symbol "Discount" indicating that they are less expensive than the first two versions.

Next, a process that is executed by the control CPU 44 in displaying an EPG as shown in FIG. 6 on the monitor 62 will be described with reference to a flowchart of FIG. 7 (alternatively, it is possible to have the OSD control section 49 execute this process). First, at step S1, the control CPU 44 renders an EPG frame as shown in FIG. 6 on a VRAM (not shown) of the OSD control section 49. Then, the process goes to step S2, where the control CPU 44 reads out program information to be displayed from the EPG data memory 51. At step S3, the control CPU 44 renders the title of the program that has been read out at step S2 on the built-in VRAM of the OSD control section 49 at a position corresponding to its broadcast hour.

Then, at step S4, the control CPU 44 judges whether a program flag exists in the information that has been read out at step S2. If a program flag exists, the process goes to step S5, where the control CPU 44 reads out the symbol data corresponding to the program flag from the program flag symbol memory 50. At step S6, the control CPU 44 causes the symbol data to be combined with the title that has already been rendered at step S3. As a result, the EPG portion corresponding to channel 107 shown in FIG. 6, for example, is rendered on the VRAM.

If it is judged at step S4 that no program flag exists, steps S5 and S6 are skipped.

Then, at step S7, it is judged whether titles have been rendered in all the display areas of the frame. If there remains a display area where no title has been rendered yet,

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the process returns to step S2 to repeatedly execute step S2 and the subsequent steps. In this manner, the EPG portions corresponding to channels 108-115 shown in FIG. 6 are rendered sequentially. If it is judged at step S7 that titles have been rendered in all the display areas of the frame, the process goes to step S8, where the control CPU 44 controls the OSD control section 49 to read out the picture data that has been rendered on the VRAM, and output it to the monitor 62 via the display processor 48 and display it thereon. As a result, the EPG as shown in FIG. 6 is displayed on the monitor 62.

FIG. 8 shows another EPG display example. In this example, an EPG 101 that is long in the vertical direction is displayed in a left-side area of the screen and a reduced picture 102 is displayed in a top-right area. The picture size reduction process is executed by the above-described display size converter 81 of the display converter 47.

An explanation of the program in the EPG 101 that is indicated by a pointer (indicated in black in FIG. 8) is displayed in a display area 103 that is under the program picture 102. Further, promotion information or the like of the program of the picture 102 being displayed is displayed in a display area 104 under the display area 103.

In the EPG 101 of FIG. 8, there are displayed a symbol "Final program" indicating that program B is the final one of series programs, a symbol "New" indicating that program E is a new program, a symbol "Excluded" indicating that program I is an excluded program, a symbol "Special feature" indicating that program K is a special feature program, and a symbol "Live" indicating that program N is live.

FIG. 9 shows a further display example. In this display example, some program titles themselves are displayed in different font, background color, or text color from the other program titles to indicate that they are characteristic programs. In the example of FIG. 9, it is shown that program A (displayed in italic) that will be broadcast from 8 hours on channel 107, program B (displayed in italic) that will be broadcast from 9 hours on channel 114, and the last two programs (displayed in a different color) of the four versions of program C that will be broadcast on channel 115 have different features than the other programs.

The fact that a certain program has a different feature than other programs can be indicated by other methods such as underlining and blinking.

Although a program flag is transmitted in the above embodiment, to display the symbol "Last" of NVOD, for example, on an EPG the broadcast start time of the last one of NVOD programs may be broadcast from the transmission side as shown in FIG. 10. In this case, the control CPU 44 of the receiving apparatus 31 executes a process shown in a flowchart of FIG. 11.

Steps S21-S23 are the same as steps S1-S3 in FIG. 7. That is, the frame of a program table is rendered, the information of one program to be displayed is read out, and its title is rendered on the VRAM.

Then, at step S24, the control CPU 44 judges based on the information that has been read out at step S22 whether that information is of an NVOD program. If it is of an NVOD program, the process goes to step S25, where the control CPU 44 judges whether the broadcast start time of the program to be displayed at the present time coincides with that of the last one of the NVOD programs. If they coincide with each other, the process goes to step S26, where the control CPU 44 reads out the symbol data of the last program that is stored in the program flag symbol memory

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50. At step S27, the control CPU 44 causes the symbol data to be combined with the title that has already been rendered at step S23.

If it is judged at step S24 that the program to be displayed at the present time is not a NVOD program or if it is judged at step S25 the broadcast start time of that program does not coincide with that of the last one of the NVOD programs, steps S26 and S27 are skipped.

Then, at step S28, it is judged whether titles have been rendered in all the display areas of the frame. If there remains a display area where no title has been rendered yet, the process returns to step S22 to repeatedly execute step S22 and the subsequent steps. If it is judged at step S28 that titles have been rendered in all the display areas of the frame, the process goes to step S29, where the EPG rendered on the VRAM is read out and displayed on the monitor 62.

Although the above embodiments are directed to the case where a signal is transmitted from the transmitting apparatus to the receiving apparatus via a satellite, the invention can also be applied to cases where a signal is transmitted by ground waves or via a cable of CATV or the like.

In the invention, the term "system" means the entire apparatus that is constituted of a plurality of apparatuses, means, etc.

In this specification, the provider that provides users with a computer program for execution of the above process includes not only recording media such as a magnetic disk, a CD-ROM, and a solid-state memory but also communication media such as a network and a satellite.

As described above, in the EPG transmitting apparatus, the EPG transmitting method, and the provider according to the first aspect of the invention, additional information to be used for displaying feature recognition information so that it is superimposed on an EPG is transmitted. Therefore, the transmission side makes it possible to impress viewers with the feature of a desired program quickly and reliably, to thereby promote reception of the program.

In the EPG receiving apparatus, the EPG receiving method, and the provider according to the second aspect of the invention, the stored feature recognition information corresponding to received and extracted additional information is displayed. Therefore, an apparatus can be realized which can reliably promote, on the reception side, viewing of a particular program.

In the EPG transmitting and receiving system, the EPG transmitting and receiving method, and the provider according to the third aspect of the invention, additional information is transmitted from an EPG transmitting apparatus and received by an EPG receiving apparatus and stored feature recognition information is displayed in the EPG receiving apparatus. Therefore, a system can be realized which promotes viewing of programs on a program-by-program basis.

In the EPG receiving apparatus, the EPG receiving method, and the provider according to the fourth aspect of the invention, whether a particular program has a feature that differentiates it from other programs is detected and feature recognition information is displayed so as to be superimposed on an EPG in accordance with a detection result. This makes enables viewers to select quickly and reliably a desired program from programs of the same kind.

What is claimed is:

1. An electronic program guide transmitting apparatus comprising:

generating means for generating an electronic program guide that represents a transmission schedule of programs to be transmitted;

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adding means for generating additional information to be superimposed on the electronic program guide, including feature recognition information for allowing a viewer to recognize a feature of a particular program that differentiates the particular program from other programs and for adding the feature recognition information to the electronic program guide; and

transmitting means for transmitting the electronic program guide to which the additional information has been added, wherein

the particular program is one of a plurality of near video on demand programs, and wherein the feature recognition information is information indicating that the particular program is a last one of the plurality of near video on demand programs.

2. The electronic program guide transmitting apparatus according to claim 1, wherein the particular program is one of a plurality of near video on demand programs, and wherein the feature recognition information is information indicating that a cost to the viewer of the particular program is different from a cost of the other plurality of near video on demand programs.

3. An electronic program guide transmitting method comprising:

a generating step of generating an electronic program guide that represents a transmission schedule of programs to be transmitted;

an adding step of generating additional information to be superimposed on the electronic program guide, including feature recognition information for allowing a viewer to recognize a feature of a particular program that differentiates the particular program from other programs and for adding the feature recognition information to the electronic program guide, wherein the adding step includes adding information to show whether the particular program is a last one of a plurality of near video on demand programs; and

a transmitting step of transmitting the electronic program guide to which the additional information has been added.

4. A provider which provides a computer program comprising:

a generating step of generating an electronic program guide that represents a transmission schedule of programs to be transmitted;

an adding step of generating additional information to be superimposed on the electronic program guide, including feature recognition information for allowing a viewer to recognize a feature of a particular program that differentiates the particular program from other programs and for adding the feature recognition information to the electronic program guide, wherein the adding step includes adding information to show whether the particular program is a last one of a plurality of near video on demand programs; and

a transmitting step of transmitting the electronic program guide to which the additional information has been added.

5. An electronic program guide receiving apparatus comprising:

receiving means for receiving an electronic program guide to which additional information to be superimposed on the electronic program guide, including feature recognition information for allowing a viewer to recognize a feature of a particular program that differentiates the particular program from other programs, is

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added, wherein the additional information includes information as to whether the particular program is a last one of a plurality of near video on demand programs;

extracting means for extracting the additional information from the electronic program guide that has been received by the receiving means;

storing means for storing information to be used for displaying the feature recognition information; and

display control means for reading out the information stored in the storing means and corresponding to the additional information that has been extracted by the extracting means and for displaying the feature recognition information, including displaying the information to show whether the particular program is the last one of the plurality of near video on demand programs.

6. An electronic program guide receiving method comprising:

a receiving step of receiving an electronic program guide to which additional information to be superimposed on the electronic program guide, including feature recognition information for allowing a viewer to recognize a feature of a particular program that differentiates the particular program from other programs, is added, wherein the additional information includes information as to whether the particular program is a last one of a plurality of near video on demand programs;

an extracting step of extracting the additional information from the electronic program guide that has been received by the receiving step;

a storing step of storing information to be used for displaying the feature recognition information; and

a display control step of reading out the information stored by the storing step and corresponding to the additional information that has been extracted by the extracting step and for displaying the feature recognition information, including displaying the information to show whether the particular program is the last one of the plurality of near video on demand programs.

7. A provider which provides a computer program comprising:

a receiving step of receiving an electronic program guide to which additional information to be superimposed on the electronic program guide, including feature recognition information for allowing a viewer to recognize a feature of a particular program that differentiates the particular program from other programs, is added, wherein the additional information includes information as to whether the particular program is a last one of a plurality of near video demand programs;

an extracting step of extracting the additional information from the electronic program guide that has been received by the receiving step;

a storing step of storing information to be used for displaying the feature recognition information; and

a display control step of reading out the information stored by the storing step and corresponding to the additional information that has been extracted by the extracting step and for displaying the feature recognition information, including displaying the information to show whether the particular program is the last one of the plurality of near video on demand programs.

8. An electronic program guide transmitting and receiving system comprising:

an electronic program guide transmitting apparatus for transmitting information, including:

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generating means for generating an electronic program guide that represents a transmission schedule of programs to be transmitted;

adding means for generating additional information to be superimposed on the electronic program guide, including feature recognition information for allowing a viewer to recognize a feature of a particular program that differentiates the particular program from other programs, and for adding the feature recognition information to the electronic program guide, wherein the particular program is one of a plurality of near video on demand programs and the feature recognition information indicates whether the particular program is a last one of the plurality of near video on demand programs; and

transmitting means for transmitting the electronic program guide to which the additional information has been added; and

an electronic program guide receiving apparatus for receiving the information transmitted from the electronic program guide transmitting apparatus, including:

receiving means for receiving the electronic program guide transmitted from the electronic program guide transmitting apparatus;

extracting means for extracting the additional information from the electronic program guide received by the receiving means;

storing means for storing information to be used for displaying the feature recognition information; and

display control means for reading out the information stored in the storing means and corresponding to the additional information that has been extracted by the extracting means and for displaying the feature recognition information, including displaying the information to show whether the particular program is the last one of the plurality of near video on demand programs.

9. An electronic program guide transmitting and receiving method for an electronic program guide transmitting and receiving system including an electronic program guide transmitting apparatus for transmitting information and an electronic program guide receiving apparatus for receiving the information transmitted from the electronic program guide transmitting apparatus, the method comprising in the electronic program guide transmitting apparatus:

a generating step of generating an electronic program guide that represents a transmission schedule of programs to be transmitted;

an adding step of generating additional information to be superimposed on the electronic program guide, including feature recognition information for allowing a viewer to recognize a feature of a particular program that differentiates the particular program from other programs, and for adding the feature recognition information to the electronic program guide, wherein the adding step includes adding information to show whether the particular program is a last one of a plurality of near video on demand programs; and

a transmitting step of transmitting the electronic program guide to which the additional information has been added, the method further comprising in the electronic program guide receiving apparatus:

a receiving step of receiving the electronic program guide transmitted by the transmitting step;

an extracting step of extracting the additional information from the electronic program guide received by the receiving step;

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a storing step of storing information to be used for displaying the feature recognition information; and

a display control step of reading out the information stored by the storing step and corresponding to the additional information that has been extracted by the extracting step and for displaying the feature recognition information, including displaying the information to show whether the particular program is the last one of the plurality of near video on demand programs.

10. A provider for providing a computer program to be used in an electronic program guide transmitting and receiving system including an electronic program guide transmitting apparatus for transmitting information and an electronic program guide receiving apparatus for receiving the information transmitted from the electronic program guide transmitting apparatus, the computer program for the electronic program guide transmitting apparatus comprising:

a generating step of generating an electronic program guide that represents a transmission schedule of programs to be transmitted;

an adding step of generating additional information to be superimposed on the electronic program guide, including feature recognition information for allowing a viewer to recognize a feature of a particular program that differentiates the particular program from other programs, and for adding the feature recognition information to the electronic program guide, wherein the adding step includes adding information to show whether the particular program is a last one of a plurality of near video on demand programs; and

a transmitting step of transmitting the electronic program guide to which the additional information has been added, the computer program for the electronic program guide receiving apparatus comprising:

a receiving step of receiving the electronic program guide transmitted by the transmitting step;

an extracting step of extracting the additional information from the electronic program guide received by the receiving step;

a storing step of storing information to be used for displaying the feature recognition information; and

a display control step of reading out the information stored by the storing step and corresponding to the additional information that has been extracted by the extracting step and for displaying the feature recognition information, including displaying the information to show whether the particular program is the last one of the plurality of near video on demand programs.

11. An electronic program guide receiving apparatus comprising:

receiving means for receiving an electronic program guide that represents a schedule of programs to be transmitted;

detecting means for detecting whether a particular program has a feature that differentiates the particular program from other programs; and

display control means for displaying, in accordance with a recognition result of the detecting means, feature recognition information for allowing a viewer to recognize that the particular program has the feature that differentiates the particular program from the other programs, so that the feature recognition information is superimposed on the electronic program guide, wherein the detecting means detects whether the particular program is a last one of near video on demand programs,

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and wherein the display control means displays the feature recognition information for allowing a viewer to recognize that the particular program is the last one of the near video on demand programs if the detecting means has detected that the particular program is the last one of the near video on demand programs. 5

12. The electronic program guide receiving apparatus according to claim 12, wherein the detecting means detects whether the particular program is the last one of the near video on demand programs based on a flag that is transmitted together with the electronic program guide. 10

13. The electronic program guide receiving apparatus according to claim 11, wherein the detecting means detects whether the particular program is the last one of the near video on demand programs based on time information that is included in the electronic program guide. 15

14. The electronic program guide receiving apparatus according to claim 11, wherein the detecting means detects whether a cost to the viewer of the particular program is different from a cost to the viewer of the other near video on demand programs, and wherein the display control means displays the feature recognition information for allowing a viewer to recognize whether the cost to the viewer of the particular program is different from that of the other of the near video on demand programs if the detecting means has detected that the cost to viewer of the particular program is different from the cost to the viewer of the other of the near video on demand programs. 20 25

15. The electronic program guide receiving apparatus according to claim 14, wherein the detecting means detects whether the cost to the viewer of the particular program is different from the cost to the viewer of the other of the near video on demand programs based on a flag that is transmitted together with the electronic program guide. 30

16. The electronic program guide receiving apparatus according to claim 11, further comprising storing means for storing the feature recognition information. 35

17. The electronic program guide receiving apparatus according to claim 16, wherein the feature recognition information is a symbol. 40

18. An electronic program guide receiving method comprising:

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a receiving step of receiving an electronic program guide that represents a schedule of programs to be transmitted;

a detecting step of detecting whether a particular program has a feature that differentiates the particular program from other programs, including detecting information relating to whether the particular program is a last one of a plurality of near video on demand programs; and

a display control step of displaying, in accordance with a recognition result of the detecting step, feature recognition information for allowing a viewer to recognize that the particular program has the feature that differentiates the particular program from the other programs, so that the feature recognition information is superimposed on the electronic program guide, including displaying the information to show whether the particular program is the last one of the plurality of near video on demand programs.

19. A provider for providing a computer program comprising:

a receiving step of receiving an electronic program guide that represents a schedule of programs to be transmitted;

a detecting step of detecting whether a particular program has a feature that differentiates the particular program from other programs, including detecting information relating to whether the particular program is a last one of a plurality of near video on demand programs; and

a display control step of displaying, in accordance with a recognition result of the detecting step, feature recognition information for allowing a viewer to recognize that the particular program has the feature that differentiates the particular program from the other programs, so that the feature recognition information is superimposed on the electronic program guide, including displaying the information to show whether the particular program is the last one of the plurality of near video on demand programs.

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Mao et al.

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(54) **SYSTEM FOR TRANSPORTING MPEG VIDEO AS STREAMING VIDEO IN AN HTML WEB PAGE**

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- (73) Assignee: **TVWorks, LLC**, Philadelphia, PA (US)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 447 days.

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H04N 7/173 (2006.01)

(52) **U.S. Cl.** **725/109; 725/88**

(58) **Field of Classification Search** **725/120, 725/109-113, 88**

See application file for complete search history.

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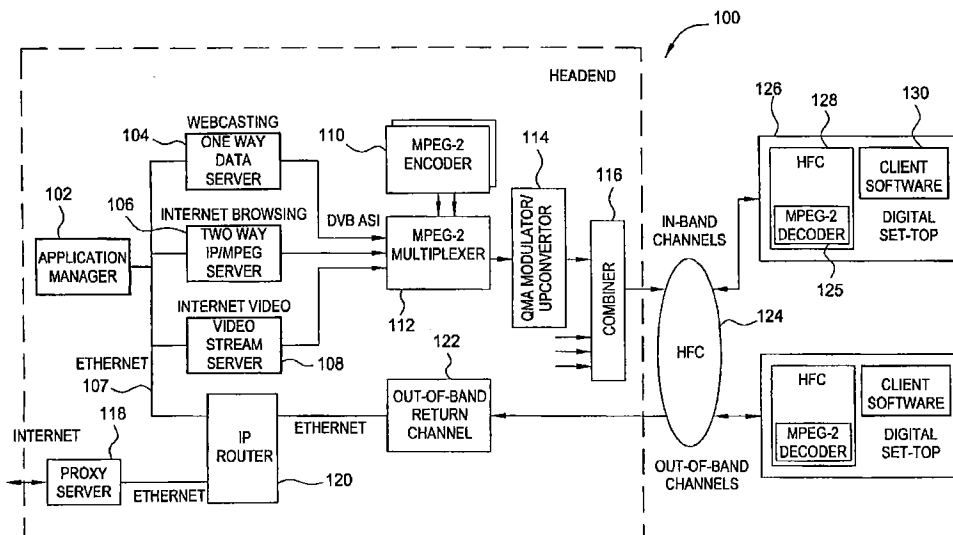
Primary Examiner—Andrew Y. Koenig

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(57) **ABSTRACT**

An implementation of streaming video in HTML (Hypertext Markup Language) Web pages combines video signals in MPEG digital television format with Internet World Wide Web pages in HTML format. Internet streaming video is transcoded into MPEG-2 digital video format and multiplexed along with other MPEG-2 digital video signals for transport within a multiple channel digital video system. A navigational control map, transmitted from the headend to the CATV set-top box in a fixed location in the MPEG-2 video data stream, permits the CATV set-top to find the requested video clip in a predetermined Packet Identifier of the MPEG-2 data stream. The viewer controls the video clip (e.g., play, pause, resume, restart etc.) during the session. In the two-way embodiment, the set-top transmits control commands to the headend, which implements the command in MPEG-2 video. The disclosed arrangement allows the available MPEG-2 decoder hardware in the CATV set-top box to be used to display streaming video without requiring additional hardware or additional RAM memory.

26 Claims, 5 Drawing Sheets



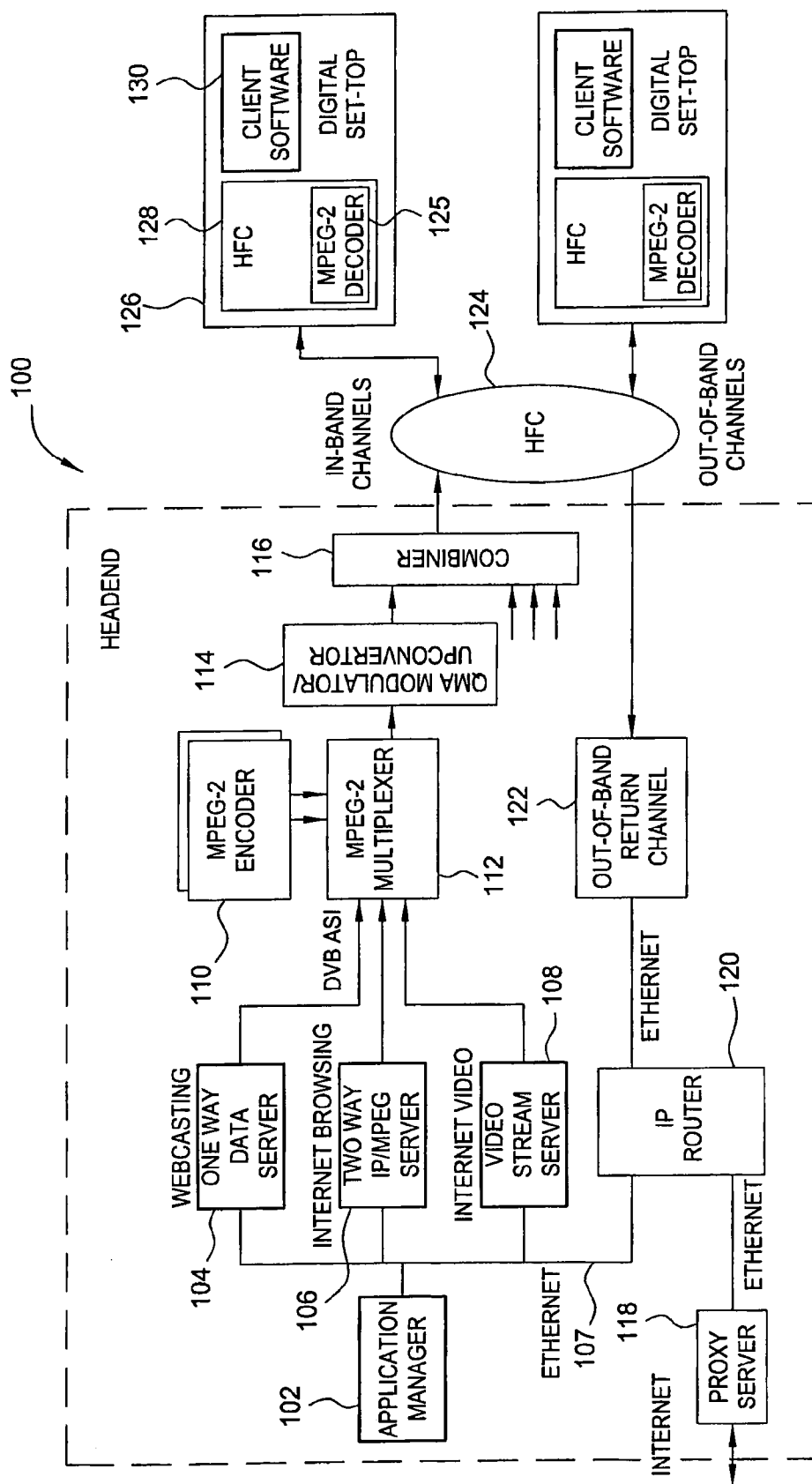


FIG. 1

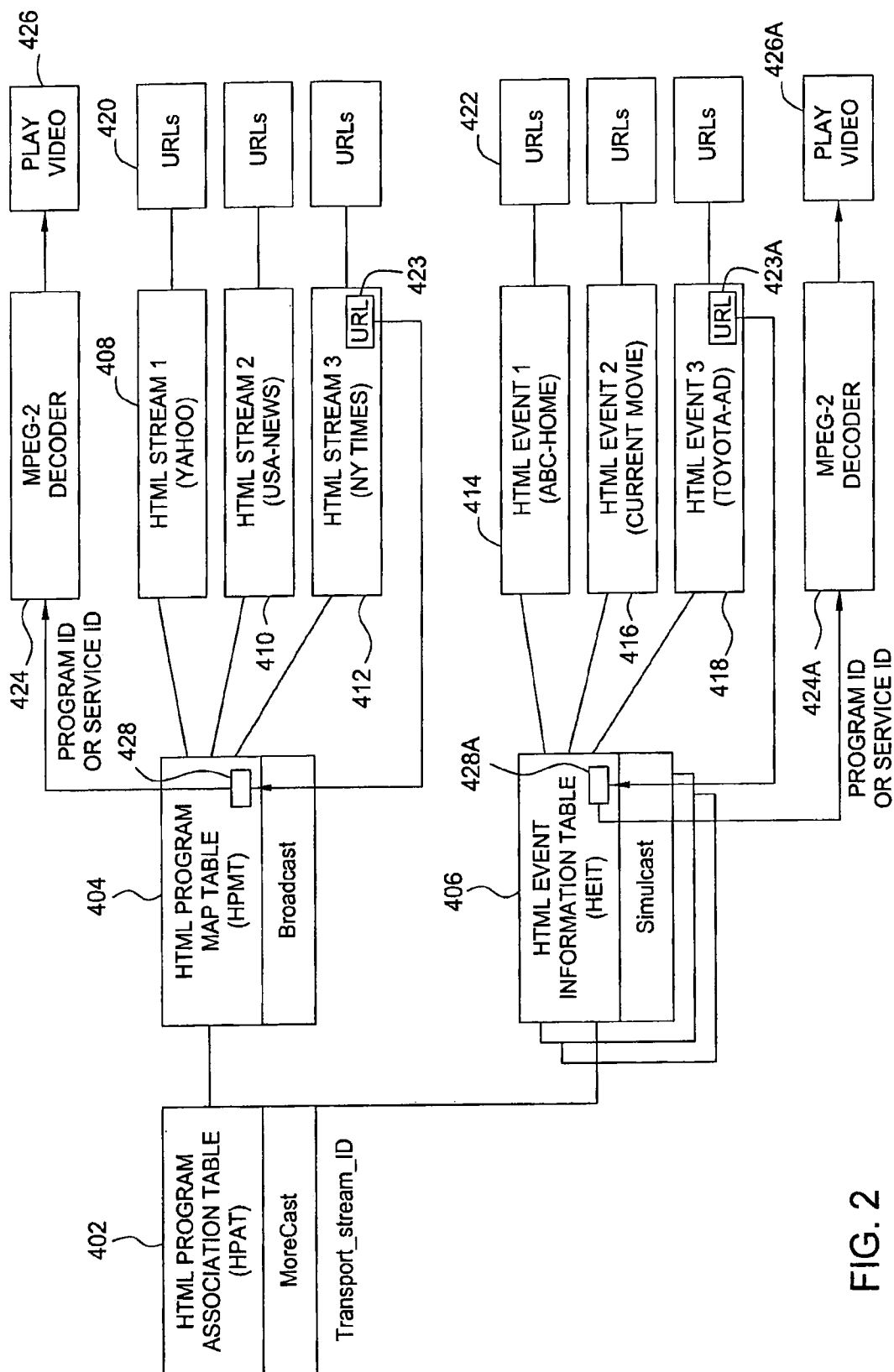


FIG. 2

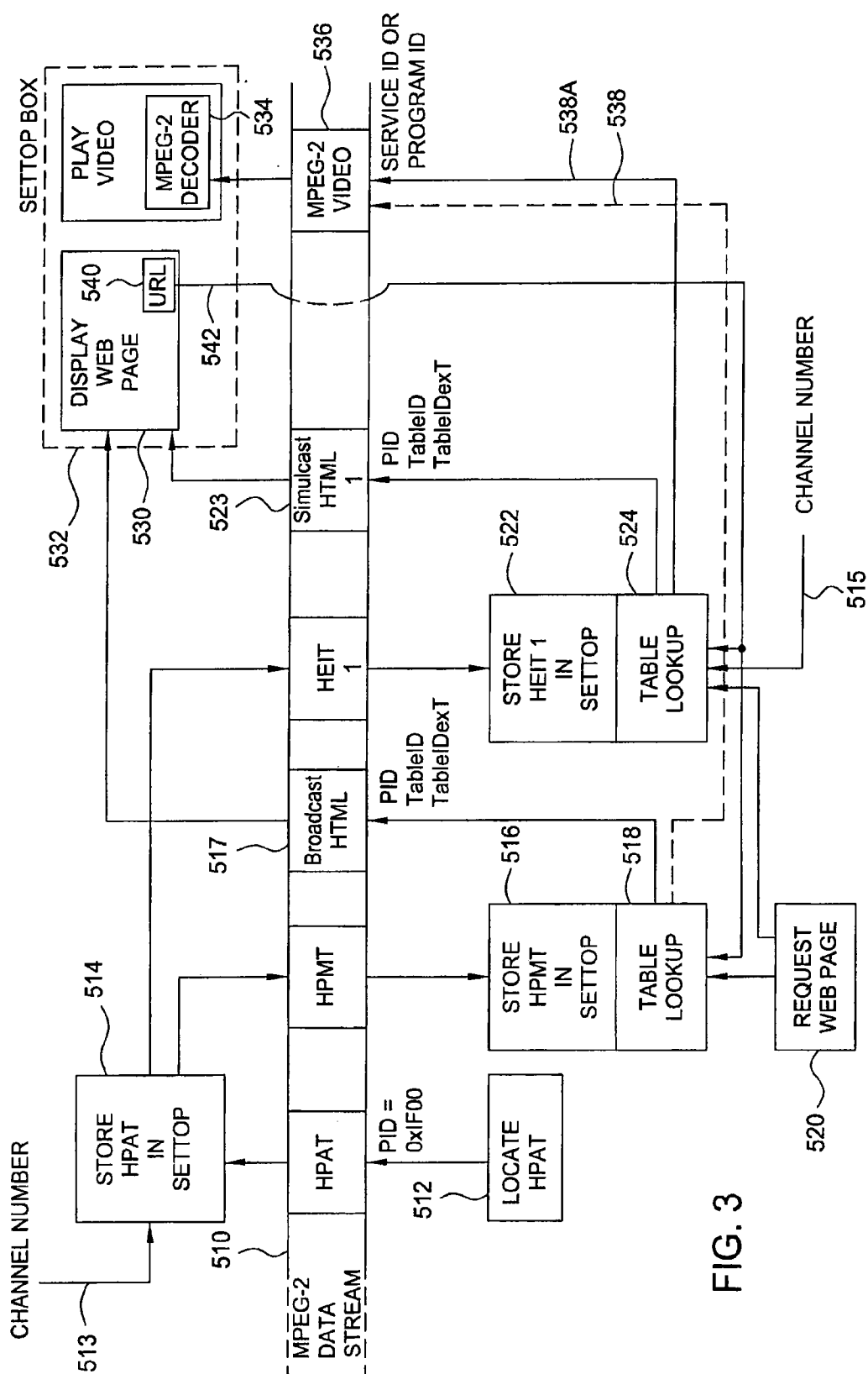


FIG. 3

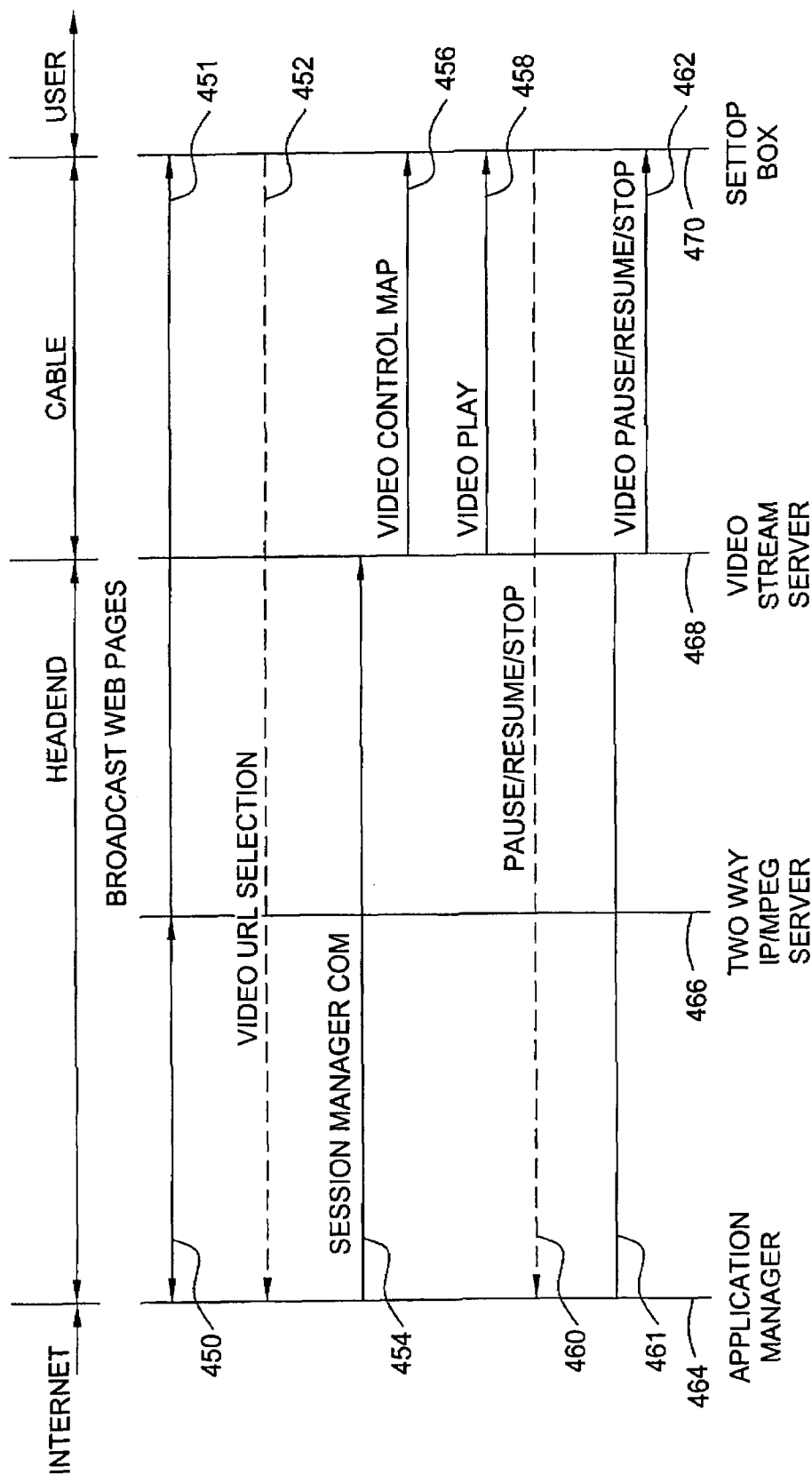


FIG. 4

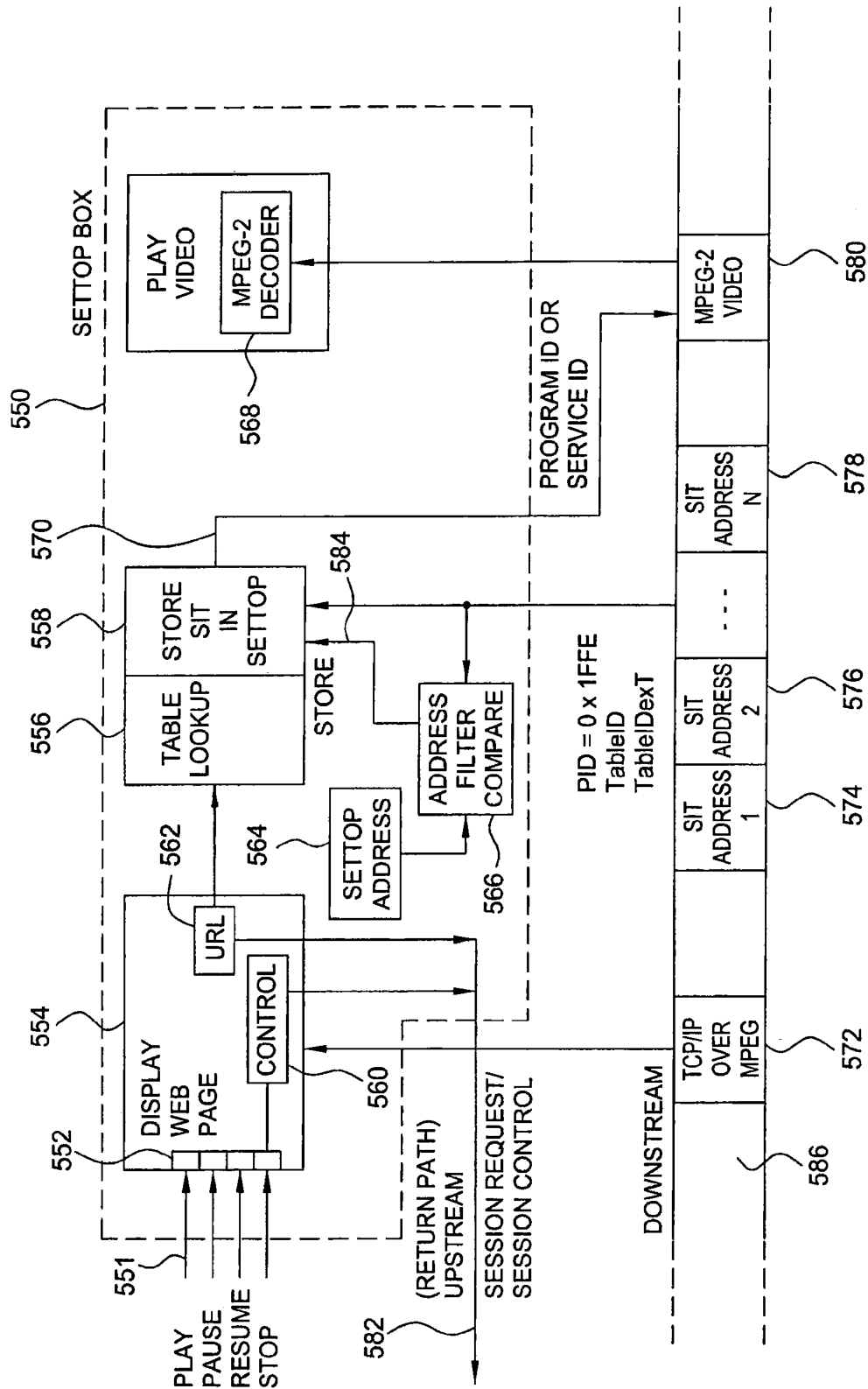


FIG. 5

SYSTEM FOR TRANSPORTING MPEG VIDEO AS STREAMING VIDEO IN AN HTML WEB PAGE

FIELD OF THE INVENTION

The present invention relates to the efficient implementation of streaming video in HTML (Hypertext Markup Language) Web pages. More particularly, the present invention relates to a system for combining video signals in MPEG digital television format with Internet World Wide Web pages in HTML format.

BACKGROUND OF THE INVENTION

Many World Wide Web sites on the Internet host pages which contain streaming video. When the user (viewer) clicks on an icon indicating a video clip, the Web server delivers a digital video data stream representing the requested video clip.

In order to play the streaming video, the video data is typically stored (cached) at the user (client) location, and run using a compatible software plug in module. One well known format for video streaming is Quicktime by Apple Computer Corporation of Cupertino, Calif. USA. Using the Quicktime software decoder, a locally stored video clip may be played, paused, resumed or replayed from the beginning. Streaming video in HTML Web pages has the potential to present video clips lasting several seconds or minutes, or even to feature length movies lasting several hours.

The Quicktime software decoder is adapted to run on a standard compatible PC or an Apple Computer Macintosh. A typical PC uses a central processing unit (CPU) based on a microprocessor from Intel Corporation running the Windows operating system from Microsoft Corporation. The Quicktime software decoder needs a computing environment having substantial resources in terms of hard disk storage, RAM memory and microprocessor speed. For example, a PC equipped to run Quicktime encoded video clips would include a Pentium class Intel microprocessor and substantial RAM memory.

Many households do not have a PC and therefore have limited access to the Internet. However, many households do have a television receiver and access to a cable television (CATV) connection. For those viewers with access to CATV, Internet connectivity can be provided over the CATV system in conjunction with the television receiver. The interface between the CATV subscriber and the CATV system is typically a CATV set-top box.

However, CATV set-top boxes are cost sensitive consumer items that use an inexpensive microprocessor and a minimum of RAM memory. As a result, most CATV set-top boxes are resource poor and ill equipped to locally store or run Quicktime encoded video clips. Video clips larger than the available RAM memory may have to be displayed in segments resulting in a wait period during which successive segments are swapped in memory. The performance of a typical CATV set-top box when running Internet delivered Quicktime streaming video is at times so slow as to be wholly inadequate.

SUMMARY OF THE INVENTION

In accordance with the present invention, Internet streaming video (such as in Quicktime format) is decoded into video and re-encoded (transcoded) into MPEG-2 digital video format at the CATV headend. The streaming video

signal transcoded into MPEG-2 format is then multiplexed along with other MPEG-2 digital video signals for transport within a multiple channel digital video system.

The streaming video signal in MPEG-2 format is delivered to the user's location, decoded and displayed in conjunction with a World Wide Web page being viewed. A digital CATV set-top box normally comes equipped with a fast MPEG-2 decoder in dedicated hardware. By use of the present invention, the available MPEG-2 decoder hardware in the CATV set-top box is advantageously used to display streaming video.

By use of the present invention, the client software providing Internet access functions in the CATV set-top box gains the advantages of MPEG-2 compression, better utilization of available CATV bandwidth and fast MPEG-2 decoding using hardware resources available in the CATV set-top box and not requiring additional hardware. In addition, no RAM memory is needed to store the video clip in the CATV set-top box, since the headend provides the video clip in MPEG-2 format.

In a first embodiment of the present invention, streaming video signal in MPEG-2 format is multiplexed along with other MPEG-2 digital video signals for transport within a one way multiple channel digital video system. The one-way embodiment provides minimal control over the playing of the video clip. In a second embodiment of the present invention, streaming video signal in MPEG-2 format is multiplexed along with other MPEG-2 digital video signals for transport within a two way multiple channel digital video system. The two-way embodiment provides full control over the playing of the video clip.

One Way CATV System

A one way system for providing Internet access over CATV is shown in co-pending patent application Ser. No. 09/124,572, filed Jul. 29, 1998 and entitled "DIGITAL TV SYSTEM WITH SYNCHRONIZED WORLD WIDE WEB CONTENT". In the above cited patent application, a rotating carousel of HTML pages is formatted to fit into an MPEG-2 data packet structure. Also shown in the cited patent application is a system of control maps, HPAT (for broadcast) and HEIT (for simulcast) which permit the user to navigate among the rotating carousel of HTML pages formatted into an MPEG-2 data packet structure. The present invention is an extension of the cited patent application to include video clips associated with the broadcast and simulcast Web pages. The associated video clips in MPEG-2 format are also continuously broadcast as a rotating carousel. In addition, the control tables HPAT and HEIT are extended to permit the user to navigate to the desired MPEG-2 video clip.

Two Way CATV System

In accordance with the present invention, video clips in Internet streaming video format are transcoded into MPEG-2 digital video format and cached at the CATV headend. The viewer requests a desired video clip by clicking on an HTML tag in the Web page being viewed. Responsive to the viewer request, a two-way session (between the headend and the CATV set-top box) is established. During the active two-way session, the requested streaming video signal in MPEG-2 format (MPEG streaming video) is multiplexed at the headend along with other MPEG-2 digital video signals for transport within a multiple channel digital video system.

To permit the CATV set-top to find the requested video clip, a navigational control map, called the Session Information Table (SIT) is transmitted from the headend in a

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fixed location in the MPEG-2 video data stream (defined by a predetermined Packet Identifier (PID)). First, the CATV set-top transmits a session request to the headend. The headend responds by placing the SIT for the session in the predetermined PID, and placing the requested video clips as MPEG-2 packets in a given service ID. A service ID (also known as a program ID) is the equivalent of a channel number. The transmitted SIT contains the address of the CATV set-top and the given service ID of the requested video clip.

After sending a session request, the CATV set-top monitors the predetermined PID of the MPEG-2 data stream looking for a SIT containing its own address. When an address match is found, located SIT is saved in memory in the CATV set-top. The stored SIT identifies the service ID where the MPEG-2 video clip is located in the MPEG-2 video stream. The video clip is then displayed at the viewer's location using the MPEG-2 decoder in the CATV set-top.

The two-way CATV system is further used to permit the viewer to control the video clip (e.g., play, pause, resume, restart etc.) during the session. A command is transmitted from the CATV set-top to the headend, e.g., a "PAUSE" command. At the headend, the video is paused, and a new Session Information Table (SIT) is transmitted to confirm the change in running status. The multiplexed MPEG-2 video shows a freeze frame in PAUSE mode. Advanced features such as fast forward and reverse are implemented.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a CATV headend in an overall system in accordance with the present invention.

FIG. 2 is a block diagram of the navigational control map architecture in a one-way CATV system in accordance with the present invention.

FIG. 3 is a timing diagram, partially in block form, illustrating a system for navigating among HTML pages and steaming video formatted into an MPEG-2 stream in a one-way CATV system in accordance with the present invention.

FIG. 4 is a timing diagram illustrating the operation of a two-way CATV system embodying the present invention.

FIG. 5 is a timing diagram, partially in block form, illustrating a system for navigation to locate steaming video formatted into an MPEG-2 stream in a two-way CATV system, including a block diagram of a CATV set-top box in accordance with the present invention.

DETAILED DESCRIPTION

A CATV headend 100 in FIG. 1 includes a computer programmed as an applications manager 102, connected via a local area network 107 (such as an Ethernet network) to three other computers programmed as servers. One server is a one way data server for Webcasting 104. Another server is a two-way IP/MPEG server 106 for Internet browsing, and a third server is a video stream server 108 for conducting video streaming sessions and storing Internet Video. The output of the servers 104, 106, 108 are combined in an MPEG-2 multiplexer 112 along with other MPEG-2 signals from MPEG-2 encoders 110 to form an MPEG-2 data stream to a QAM modulator and upconverter 114. The output of the QAM modulator and upconverter 114 is combined with other broadband signals and transmitted on a hybrid fiber coaxial (HFC) two-way broadband CATV distribution system 124. CATV headend 100 in the one-way embodiment

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may also be implemented by other one-way broadcast technologies, such as satellite or terrestrial broadcast and the like.

Each of a plurality of digital set-tops 126 is coupled to the HFC network 124, which may also be any broadcast medium compatible with the broadcasting station (headend 100). Each of the plurality of digital set-tops 126 contains an HFC interface module 128, an MPEG-2 decoder 125 and client software 130 for providing set-top functionality. The client software 130 is downloadable from the headend 100 via the HFC network 124. In such manner, software updates and additional functions for the set-top may be downloaded from the headend.

Return path signals from the set-top 126 through the HFC network 124 is received at the headend 100 in a receiver 122 tuned to the out of band return channels. The headend 100 is also connected to the Internet via a proxy server 118, coupled to an IP router 120, which via the local area Ethernet network 107 provides TCP/IP connectivity between the headend video servers 104, 106, 108 and the out of band return channel receiver 120. Proxy server 118 is an Internet access server, which provides access to Internet World Wide Web pages in HTML format in the headend 100.

For two-way systems, all three headend data servers 106, 108 and 104 implement the two-way embodiment of the present invention. For one-way systems, data servers 104 and 108 implement the one-way embodiment of the present invention.

One Way System Architecture

In the above cited pending patent application, HTML page data is formatted to fit within the standard MPEG-2 data packet structure and multiplexed along with other MPEG-2 digital video signals for transport within a multiple channel digital video system. In such manner, the Internet HTML protocol is preserved, and mapped to the MPEG-2 transport format, resulting in HTML in an MPEG video channel.

By way of brief review of the one-way system (more fully described in the above-cited patent application), the headend server broadcasts a rotating carousel comprising an ensemble of Web pages in HTML format. The rotating carousel contains both broadcast Web pages and simulcast Web pages. Broadcast Web pages are of general interest to all viewers. Simulcast Web pages are related to the contents of the broadcast video programs contained in the digital video channels. Simulcast Web pages are of interest primarily to those viewing the related broadcast video program.

Navigation Among Web Pages in the Rotating Carousel

To permit the viewer to navigate among the broadcast or simulcast HTML Web pages, in the above cited application, a control map is broadcast in the MPEG-2 data stream. The control map consists of three types of tables. The first table is a master control map, in that the first table defines the locations of the second and third tables. The first table is termed the HTML Program Association Table or HPAT. The second and third tables respectively, are termed the HTML Program Map Table (HPMT), and the HTML Event Information Table (HEIT). The HTML Program Map Table contains the location of HTML Web pages in the rotating carousel that correspond to broadcast Web pages. The HTML Event Information Table contains the location of the HTML Web pages in the rotating carousel that correspond to simulcast Web pages. There is one HTML Event Information Table (HEIT) for each video channel, which HEIT associates at least one simulcast Web page in the rotating data carousel with that video channel.

First, the MPEG-2 decoder in the set-top is synchronized with the MPEG-2 data stream as is normally done in MPEG-2 decoding. Then the set-top looks for and downloads the HTML Program Association Table, which is found in a predetermined data packet within the MPEG-2 data stream format. The set-top then uses the HTML Program Association Table to locate, download and store the other two tables, HPMT and HEIT. After the first, second and third tables are downloaded and stored, the set-top is responsive to viewer commands to navigate through the broadcast Web pages, or the simulcast Web pages of the continuous rotating carousel.

Broadcast Web Pages

Broadcast Web sites are popular sites that are of interest to all viewers. Typical broadcast Web sites contain news, weather and sports, but can be any Web site of general interest to many viewers. The viewer selects an available broadcast Web site from a menu displayed on the TV.

To view a broadcast Web site such as the <http://www.NYTimes.com>, the HTML Program Map Table is used as a lookup table to find the MPEG-2 data packet within the MPEG-2 data stream corresponding to the NY Times web page. Location within the MPEG-2 data stream is defined by a packet identifier (PID), a table identifier (tableID) and table identifier extension (tableIDext). The set-top monitors the rotating carousel until the designated MPEG-2 data packet location appears and then the HTML page data at that location in the MPEG-2 data stream is stored in the subscriber's set-top and displayed on the television screen.

The home page at NYTimes.com will typically display links to other pages by designating a URL. As is normal for Internet navigation, the user clicks on, (or otherwise indicates a desire to select) a displayed link to another Internet page. To find the linked HTML pages, the designated URL is looked up in the HTML Program Map Table, which provides the location of the desired HTML page in the MPEG-2 data packet within the MPEG-2 data stream corresponding to the designated URL web page. The rotating carousel will normally contain all or most of the linked page URLs. As indicated, a location within the MPEG-2 data stream is defined by a packet identifier (PID), a table identifier (tableID) and table identifier extension (tableIDext). The set-top monitors the rotating carousel until the designated MPEG-2 data packet location appears and then the HTML page data at that location in the MPEG-2 data stream is stored and displayed.

Simulcast Web Pages

To view a simulcast Web site such as <http://www.toyota.com>, during a Toyota commercial, the HTML Event Information Table for the corresponding video channel is used as a lookup table to find the MPEG-2 data packet within the MPEG-2 data stream corresponding to the Toyota web page. The set-top monitors the rotating carousel until the designated MPEG-2 data packet appears which is then stored and displayed. The content of the HTML Event Information Table is synchronized to the broadcast video program.

Whereas the available broadcast Web pages are changed relatively infrequently (by changing the content of the HPMT) the available simulcast Web pages are changed (by changing the content of the HEIT) relatively frequently, whenever the corresponding broadcast video program changes.

The home page at Toyota.com will typically display links to other pages by designating a URL. As with broadcast web pages, links to other URLs in simulcast web pages are looked up in the appropriate table. In the case of simulcast

Web pages, the HTML Event Information Table, HEIT is used to find the linked HTML pages. The designated URL is looked up in the HEIT table, which provides the location of the desired HTML page in the MPEG-2 data stream corresponding to the designated URL web page. As indicated above, the set-top monitors the rotating carousel until the designated PID, tableID and tableIDext appears in the MPEG-2 data stream, and then the HTML page data at that location in the MPEG-2 data stream is stored and displayed.

The content of the HTML Event Information Table defines the links between broadcast video programs and related Web sites. Broadcast video may have advertising and/or entertainment content, and a video broadcast program content provider may be either a programmer and/or an advertiser. The event information and its relationship to locations on the World Wide Web is obtained in individual communications sessions at the broadcasting station established over the Internet and then down loaded into each set-top through the HTML Event Information Table. In particular, in the case of CATV, the headend communicates with the individual web sites of each broadcast video content provider to obtain the relationship between broadcast video program content and corresponding web pages in the rotating carousel.

The relationship between the various tables of the control map to the broadcast and simulcast Web pages is illustrated in FIG. 2. The HPAT 402 is the control map of control maps in that the HPAT 402 locates the other two control maps, HPMT 404 (for broadcast Web pages) and HEIT 406 (for simulcast Web pages).

The HPMT 404 designates a plurality of broadcast Web pages within the rotating data carousel, such as Yahoo 408, USA-News 410 and NY times 412. Each of the designated broadcast Web pages contain other URLs 420 as links to other Web pages.

The HEIT 406 designates a plurality of simulcast Web pages within the rotating data carousel, such as ABC-home, 414, a current movie home page 416 and a Toyota ad 418. Each of the designated simulcast Web pages contain other URLs 422 as links to other Web pages.

Some of URLs 423, 423A contained in broadcast and simulcast Web pages represent streaming video content. In the case of a broadcast Web page 412, the HPMT broadcast table 404 is used to lookup a service ID 428. The service ID 428 directs the MPEG-2 decoder 424 to the location in the MPEG-2 data stream where the desired streaming video 426 is located. In the case of a simulcast Web page 418, the HEIT simulcast table 406 is used to lookup a service ID 428A. The service ID 428A directs the MPEG-2 decoder 424A to the location in the MPEG-2 data stream where the desired streaming video 426A is located.

The navigation in the set-top provided by the control maps HPAT and HEIT to find a desired Web page within the MPEG-2 data stream is illustrated in FIG. 3. In particular, within the MPEG-2 data stream 510, there is a desired broadcast Web page HTML 517, a desired simulcast Web page HTML 523 and a desired video clip 536 in MPEG-2 format.

To navigate to the desired Web page HTML 517, the set-top first finds the HPAT (at a predetermined MPEG-2 location, for example, PID=0x1f00) at step 512. The HPAT is then stored in the set-top at step 514. The set-top uses the HPAT to locate the HPMT and stores the located HPMT at step 516. In response to a broadcast Web page request 520, a table lookup function 518 finds the PID, tableID and tableIDext needed to locate the desired broadcast HTML Web page 517 in the rotating data carousel of the MPEG-2

data stream. The located broadcast HTML page 517 is stored in the set-top and displayed 530. The maximum latency of the system to find a given HTML Web page is the amount of time it takes the rotating carousel of HTML Web pages to repeat itself.

For simulcast, the set-top uses the stored HPAT (in step 514) together with the current channel number input 513, to locate the necessary HEIT. In this case, HEIT 1 corresponds to the simulcast Web pages relating to the current channel number being viewed. The located HEIT 1 is then stored in the set-top at step 522. All the other HEITs, for which there is one simulcast channel, are similarly located and stored.

In response to a simulcast Web page request 520, a table lookup 524 finds the appropriate PID, tableID and tableIDext in the stored HEIT 1, needed to locate the desired simulcast HTML 1 Web page 523 in the rotating data carousel of the MPEG-2 data stream. The located HTML simulcast page 523 is stored in the set-top and displayed 530.

The content of simulcast HTML 1 Web page corresponds to the current channel being viewed. The current channel number is input 515 to the table lookup step 524. Each simulcast channel has one corresponding HEIT.

As indicated, the located broadcast HTML page 517 or simulcast Web page 523 is stored in the set-top and displayed 530. For either broadcast or simulcast, the displayed Web page 530 may contain a URL 540 corresponding to a video clip 536. In response to clicking on the URL 540 for broadcast streaming video, the table lookup function 518, finds the stored service ID (program ID) 538 in the HPMT table 516 needed to locate the desired broadcast MPEG-2 video clip 536 in the MPEG-2 data stream 510. In response to clicking on the URL 540 for simulcast streaming video, the corresponding table lookup function 524 finds the stored service ID (program ID) 538A in the HEIT 1 table 522 needed to locate the desired simulcast MPEG-2 video clip 536 in the MPEG-2 data stream 510. In either case, the located MPEG-2 video clip 536 is applied to the MPEG-2 decoder 534 and displayed as video.

Each MPEG-2 video clip 536 is transmitted continuously in an endless repeating loop. Several options exist for user control over the display of the video clip 536. The simplest option is to tune to the continuously broadcast MPEG-2 video clip 536 as soon as possible after clicking on the URL 540, even though the video clip display will be starting at some random point. By tuning in immediately, the video clip 536 will appear with minimum latency of about 3 seconds or less. The viewer can wait until the video clip runs from the beginning to view the entire video clip, or may discontinue viewing the video clip after reaching the random point where the viewer first began playing the video clip 536.

A second option is to provide timing information either in the control tables 516, 522 or the MPEG-2 video 536 to indicate the start of video clip. The set-top box then waits until the beginning of the video clip 536 before activating the MPEG-2 decoder 534. The maximum latency of the system to find the beginning of a given MPEG-2 video clip is the length of time it takes for the MPEG-2 video clip 536 to repeat itself.

To reduce the latency, multiple delayed versions of the MPEG-2 video clip 536 are transmitted continuously in multiple endless repeatedly loops. Multiple repeating loops of MPEG-2 video clips trade off bandwidth for shorter latency time in beginning each video clip. For example, transmitting four multiple delayed versions of the video clip 536 will use four times the amount of bandwidth, but will also reduce the maximum latency by a factor of four.

Multiple delayed versions also permit limited advanced control functions, such as SKIP, REWIND, and the like. The later advanced control functions are achieved by navigating among the multiple delayed versions of the video clip 536.

The operation of a two-way CATV system embodying the present invention is illustrated in the timing diagram of FIG. 4. The system consists of four computing entities. At the headend there is an application manager 464 (102 in FIG. 1), a two way IP/MPEG server 466 (106 in FIG. 1) and a video stream server 468 (108 in FIG. 1). The set-top 470 (126 in FIG. 1) is at the viewer (user) location. In FIG. 4, various messages are exchanged between the four computing entities 464, 466, 468, 470.

In operation, a Web page from the Internet is cached by the application manager 464, forwarded 450 to the two way IP/MPEG server 466 and transmitted 451 over the CATV system (HFC) to the CATV set-top 470. In the two-way embodiment, Web pages are transported using the DVB standard for TCP/IP over MPEG cable See section 7 of the European Broadcasting Union DVB specification EN 301 192 v1.1.1, published by the European Standards Institute (1997) for a description of the TCP/IP over MPEG cable standard. However, the Web page 450 may also be broadcast as part of a rotating carousel of HTML Web pages, as more fully described in the above cited pending patent application.

When the user selects a URL representing streaming video in the Web page being viewed, the selected URL is transmitted 452 back to the application manager 464 in a session request. Return path transport is standard TCP/IP over MPEG cable. The application manager establishes a communication (COM) session and sends a message 454 to the video stream server 468 which transmits a video control map 456 to the set-top 470. The video control map 456, also called the Session Information Table, or SIT, is broadcast in a predetermined PID of the MPEG-2 data stream, and addressed to a specific set-top 470 by the tableIDext field. That is, all set-tops use the same PID to transport the control map (SIT) but use the tableIDext field to filter out the right address. At substantially the same time or shortly thereafter, regular MPEG-2 video 458 corresponding to the requested video clip is transmitted to the set-top 470.

The URL in the session request 452 represents streaming video. If the application manager 464 has not recently cached streaming video for the URL in the session request at the headend, the Internet access server (proxy server 118 in FIG. 1) retrieves the desired streaming video from the designated URL on the Internet. The added or updated streaming video for that URL is cached in the proxy server, transcoded into MPEG-2 video format and stored in the application manager 464. The proxy server and the application manager 464 operate to cache streaming video at the headend, thus storing Internet streaming video content closer to the user.

The viewer at the set-top box 470 location controls the play of the video clip by selecting (clicking on) an action control icon, such as PLAY, PAUSE, RESUME etc. The viewer's control action is transmitted back 460 to the application manager 464, which modifies the running status of the COM session to reflect the viewer's selected control action. In accordance with the new running status, the application manager 464 sends a new communication (COM) message 461 to the video stream server 468 which transmits a modified SIT control map 462 to the set-top 470. For example, from the SIT table definition below, if PAUSE was selected, the running status is change to equal 4 (PAUSE).

The modified control map 462 reflects the new running status of the video clip. The video play 458 (in MPET-2 digital packet format) is also modified to correspond to the viewer's selected control action. Continuing the above example, if PAUSE was the selected action, the video play 458 corresponding to the selected video clip shows a stop action video still picture, thereby simulating a paused video clip.

The attributes for a session are described in the following tables. The basic functions provided by the COM Interface are add session, delete session, pause session and resume session. The COM interface and Session Information Table are given below.

TABLE 1

Definition of Session (COM Interface)			
Field	Data Type	Assigned by	Comments
SessionID	int32	Server	Unique ID generated by the application server for each request. The sessionID can be reused once the session end time is reached. At each time, the sessionID is unique across all the sessions per head-end.
SessionType	int8	Server	Type of session: Use "1" for Video clip session
ClientID	int32	Client	4 byte (32 bit) IP address of the set-top. Application server obtains this from proxy server and client.
ClientAddress	int64	Client	6 byte (48 bit) MAC address of the set-top. Pre-assigned by operator and known by the application server. The mapping of IP address to MAC address is also known by the application server.
VideoURLName	char**	Provider	The name of the video URL. Currently, each URL name is less than 255 bytes and /0 terminated. In Video clip case, only one video URL name is allowed.
VideoFileName	Wchar*	Server	File name of the video stream. There is one to one correspondences between the URL and file name. In Video clip case, only one video URL file name is used and it is cached ahead of time in broadcast streaming

TABLE 2

Video Control Map Definition (Session Information Table)		
Structure of the Video clip Control Map (SIT)		
Syntax	No. of Bits	Value
Session_Information_Section()		
{		
tableID	8	"0x3E"
section_syntax_indicator	1	"1"
"0"	1	
reserved	2	"11"
section_length	12	section maintained
clientAddress_6	8	user defined
clientAddress_5	8	user defined
reserved	2	"11"
version_number	5	user defined (s)
current_next_indicator	1	"1"
section_number	8	section maintained
last_section_number	8	section maintained

TABLE 2-continued

Video Control Map Definition (Session Information Table) Structure of the Video clip Control Map (SIT)			
Syntax	No. of Bits	Value	
clientAddress_4	8	user defined	
clientAddress_3	8	user defined	
clientAddress_2	8	user defined	
clientAddress_1	8	user defined	
sessionID	32	user defined	
sessionType	8	user defined	
clientID	32	user defined	
serviceID	16	user defined	
duration	32	user defined	
runningStatus	8	user defined	
urlName	variable	user defined	
CRC_32	32	section maintained	
}			

Notes:

1. tableID: use default value of 0x3E.
2. client_Address_6: last byte of client MAC address
3. client_Address_1: first byte of client MAC address
4. serviceID: a list of serviceID and its associated PIDs are predetermined in a configuration file.
5. duration: the duration of the remaining time of the complete video clip in second
6. runningStatus: the status of the video session:
 - "0": Begin (beginning of the session, and playing of the video)
 - "1": End (end of the session, and stopping of the video)
 - "2": Start (start playing video from the beginning)
 - "3": Play (normal play from the current position)
 - "4": Pause (pause at the current position, set-top shows freeze frame)
 - "5": Stop (stop at the current position)
 - "6": Fast Forward
 - "7": Fast Reverse
 - "8": Skip Forward
 - "9": Skip Backward
 - "10": Time out

The block diagram portion of FIG. 5 shows a set-top decoder 550 for implementing the foregoing navigation scheme. FIG. 5 is also in part a timing diagram illustrating how the set-top 550 navigates the MPEG-2 data stream 586 to locate the specific service ID 570 corresponding to the desired MPEG-2 steaming video 580.

The CATV set-top box 550 includes the capability for displaying a Web page 554. The displayed Web page 554 is typically obtained via TCP/IP over MPEG packets 572 as described in the above cited DVB standard for TCP/IP over MPEG cable. Set-top 550 is also addressable and stores a unique set-top address 564 for the purpose of conducting video clip sessions. Addressable communication with the set-top 550 is implemented by an address filter 566 which compares the set-top address 564 with incoming messages in an addressable data stream containing set-top addresses, and provides a match 584 indicating when a message addressed to this particular set-top 550. The set-top 550 further includes memory 558 for storing the SIT table and a table lookup function 556 for finding table entries based on a given URL 562. Finally, the set-top 550 includes a hardware based MPEG-2 decoder 568 for decoding and displaying MPEG-2 encoded digital video.

Web page 554, which includes a URL 562 for streaming video typically has a control menu 552 with anchors for selecting video clip controls such as PLAY, PAUSE, RESUME or STOP, which permit the viewer to control the display of the streaming video.

In operation, the set-top 550 generates video clip session requests 582. Specifically, in response to the user selecting a video clip URL 562, a return path message 582 is formatted in standard http protocol (hypertext transfer protocol)

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using standard TCP/IP over MPEG cable and transmitted upstream to the headend. At a minimum, the return path message 582 includes the identity of the set-top box (set-top address 564 or a serial number), the URL 562 of the desired video clip and a video clip control command 552, such as a PLAY command 551.

In response to the video clip session request 582, a SIT table for this particular set-top address 564 is placed in a predetermined location in the MPEG-2 data stream 586. In particular, the PID carrying the SIT is defined as 0x1FFE. Each set-top that has an active video clip session in progress is assigned a separate SIT.

All set-tops in the CATV system use the same PID for delivery of each respective SIT control map 574, 576, 578. Each set-top uses one of the tableIDext fields of PID=0x1FEE as an address to filter out the respective SIT. In particular, PID 0x1FFE includes a plurality of SIT tables 574, 576, 578 addressed to different set-tops in the CATV system. When the SIT addressed for this particular set-top 550 is encountered in the MPEG-2 data stream 586, the address filter comparator 566 indicates a match 584, which stores the received SIT in memory 558.

After the SIT table is stored 584 in memory 558, the URL 562 of the video clip is used as the input to a table lookup function 556. The SIT table contains the service ID where the MPEG-2 encoded video clip 580 is located in the MPEG-2 data stream 586. The MPEG-2 decoder 568 is directed to select and display the located video clip 580. Since the control status is PLAY, the headend renders video clip 580 as active motion.

If the viewer then selects a different command 552, such as PAUSE, then the control program module 560 generates a new video clip session control request 582 using standard HTTP protocol in TCP/IP over MPEG cable. The headend confirms the change in running status by setting the running status equal to 4 in the SIT table for set-top 550, and downloading the updated SIT table by addressable message as above. In addition, the headend implements the video clip control action by pausing (displaying a freeze frame) the MPEG-2 video program 580 in the MPEG-2 data stream 586. The latency of the play, stop, pause and resume control actions for a two-way network should not exceed 3 seconds. Advanced control functions include fast forward, fast reverse, skip forward, skip reverse and time out.

What is claimed is:

1. In a broadcast communication network including a broadcasting station for transmitting on a broadcast medium, and a set-top decoder coupled to said broadcast medium, said broadcasting station including an Internet access server for retrieving World Wide Web pages, wherein at least a given World Wide Web page contains a given URL corresponding to streaming video in a first data format, said broadcast communications network further including a multi-channel digital television signal, each program channel of said multi-channel digital television signal being identified by a respective program ID, a method for displaying said given World Wide Web page containing said streaming video at said set-top decoder, said method comprising:
 - receiving digital data in a standard Internet Protocol over the Internet, said digital data being derived from said given World Wide Web page associated with said streaming video;
 - dividing said digital data in said standard Internet Protocol into a plurality of digital data packets while preserving said standard Internet Protocol;
 - mapping said plurality of digital data packets to the MPEG data packets of an MPEG data stream;

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storing said streaming video in said first data format corresponding to said given URL at said broadcasting station;

transcoding said streaming video from said first data format into an MPEG digital video format at said broadcasting station to form MPEG streaming video; transmitting said MPEG data packets in said MPEG data stream over said broadcast communication network; transmitting said MPEG streaming video in said MPEG digital video format in a given program ID of said multi-channel digital television signal over said broadcast communication network; and at said set-top decoder,

receiving said multi-channel digital television signal; receiving said MPEG data stream containing said MPEG data packets and said plurality of digital data packets at said set-top decoder to recover said digital data in standard Internet Protocol;

displaying said digital data in standard Internet Protocol at said set-top decoder, said digital data corresponding to said given World Wide Web page containing said given URL;

selecting said given URL;

selecting, responsive to selection of said given URL, said given program ID corresponding to said MPEG streaming video; and

displaying said MPEG streaming video corresponding to said given program ID,

whereby said digital data corresponding to said given World Wide Web page is broadcast in said standard Internet Protocol format, and said streaming video portion corresponding to said given World Wide Web page is broadcast in said MPEG digital video format.

2. A network method in accordance with claim 1, wherein said multi-channel digital television signal is formatted into a plurality of MPEG data packets, said method further comprising:

generating a control map defining the correspondence between said given URL and said given program ID;

formatting said control map into said MPEG data packets; and at said set-top decoder,

receiving said MPEG data packets including said control map; and

selecting said program ID from said control map corresponding to said given URL.

3. A network method in accordance with claim 2, wherein said control map further comprises a first table and a second table, each of said plurality of MPEG data packets being identified by a respective packet identifier, said method further comprising:

transmitting said first table in an MPEG data packet corresponding to a predetermined packet identifier; and

transmitting said second table in an MPEG data packet having a packet identifier specified in said first table said second table defining the correspondence between said given URL and said given program ID.

4. A network method in accordance with claim 3, further comprising:

receiving said first table in said MPEG data packet corresponding to said predetermined packet identifier;

receiving said second table in said MPEG data packet having said packet identifier specified in said first table; and

selecting at said set-top decoder, responsive to said second table, said given program ID.

5. A network method in accordance with claim 2, wherein said broadcast communication network includes a return

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path communication channel from said set-top decoder to said broadcasting station, and wherein said given World Wide Web page further contains a control icon corresponding to a change in running status of said MPEG streaming video, said method further comprising:

transmitting a request from said set-top decoder to said broadcasting station on said return path communication channel to change the running status of said MPEG streaming video;

generating a revised control map at said broadcasting station, said revised control map defining the correspondence between said given URL and said given program ID containing said MPEG streaming video having a changed running status;

formatting said revised control map into said MPEG data packets; and at said set-top decoder;

receiving said MPEG data packets including said revised control map; and

selecting, responsive to said revised control map and responsive to said given URL, said program ID corresponding to said MPEG streaming video having a changed running status for display.

6. In a broadcast communication network including a broadcasting station for transmitting on a broadcast medium, and a set-top decoder coupled to said broadcast medium, said broadcasting station including an Internet access server for retrieving World Wide Web pages, wherein at least one a given World Wide Web page contains a given URL corresponding to streaming video in a first data format, said broadcast communications network further including a multi-channel digital television signal, each program channel of said multi-channel digital television signal being identified by a respective program ID, a method for transmitting said given World Wide Web page containing said streaming video to said set-top decoder, said transmitting method comprising:

receiving digital data in a standard Internet Protocol over the Internet, said digital data being derived from said given World Wide Web page associated with said streaming video;

dividing said digital data in said standard Internet Protocol into a plurality of digital data packets while preserving said standard Internet Protocol;

mapping said plurality of digital data packets to the MPEG data packets of an MPEG data stream;

storing said streaming video in said first data format corresponding to said given URL at said broadcasting station;

transcoding said streaming video from said first data format into an MPEG digital video format at said broadcasting station to form MPEG streaming video;

transmitting said MPEG data packets in said MPEG data stream over said broadcast communication network; and

transmitting said MPEG streaming video in said MPEG digital video format in a given program ID of said multi-channel digital television signal over said broadcast communication network to said set-top decoder.

7. A transmitting method in accordance with claim 6, wherein said multi-channel digital television signal is formatted into a plurality of MPEG data packets, said transmitting method further comprising:

generating a control map defining the correspondence between said given URL and said given program ID; and

formatting said control map into said MPEG data packets.

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8. A transmitting method in accordance with claim 7, wherein said control map further comprises a first table and a second table, each of said plurality of MPEG data packets being identified by a respective packet identifier, said transmitting method further comprising:

transmitting said first table in an MPEG data packet corresponding to a predetermined packet identifier; and transmitting said second table in an MPEG data packet having a packet identifier specified in said first table said second table defining the correspondence between said given URL and said given program ID.

9. A transmitting method in accordance with claim 7, wherein said broadcast communication network includes a return path communication channel from said set-top decoder to said broadcasting station, and wherein said given World Wide Web page further contains a control icon corresponding to a change in running status of said MPEG streaming video, said transmitting method further comprising:

receiving a request from said set-top decoder to said broadcasting station on said return path communication channel to change the running status of said MPEG streaming video;

generating a revised control map at said broadcasting station, said revised control map defining the correspondence between said given URL and said given program ID containing said MPEG streaming video having a changed running status;

formatting said revised control map into said MPEG data packets; and

transmitting said MPEG data packets including said revised control map to said set-top decoder.

10. In a broadcast communication network including a broadcasting station for transmitting on a broadcast medium, and a set-top decoder coupled to said broadcast medium, said broadcasting station including an Internet access server for retrieving World Wide Web pages, wherein at least a given World Wide Web page contains a given URL corresponding to streaming video in a first data format, said broadcast communications network further including a multi-channel digital television signal, each program channel of said multi-channel digital television signal being identified by a respective program ID, said broadcasting station including receiving digital data in a standard Internet Protocol over the Internet, said digital data being derived from said given World Wide Web page associated with said streaming video, dividing said digital data in said standard Internet Protocol into a plurality of digital data packets while preserving said standard Internet Protocol, mapping said plurality of digital data packets to the MPEG data packets of an MPEG data stream, storing said streaming video in said first data format corresponding to said given URL at said broadcasting station, transcoding said streaming video from said first data format into an MPEG digital video format at said broadcasting station to form MPEG streaming video, transmitting said MPEG data packets in said MPEG data stream over said broadcast communication network, and transmitting said MPEG streaming video in a given program ID of said multi-channel digital television signal over said broadcast communication network; and at said set-top decoder, a method for displaying said streaming video at said set-top decoder comprising:

receiving said multi-channel digital television signal;

receiving said MPEG data stream containing said MPEG data packets and said plurality of digital data packets at said set-top decoder to recover said digital data in standard Internet Protocol;

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displaying said digital data in standard Internet Protocol at said set-top decoder,
 said digital data corresponding to said given World Wide Web page containing said given URL;
 selecting said given URL;
 selecting, responsive to selection of said given URL, said given program ID corresponding to said MPEG streaming video; and
 displaying said MPEG streaming video corresponding to said given program ID,
 whereby said digital data corresponding to said given World Wide Web page is received in said standard Internet Protocol format, and said streaming video portion corresponding to said given World Wide Web page is received in said MPEG digital video format.

11. A method in accordance with claim 10, wherein said multi-channel digital television signal is formatted into a plurality of MPEG data packets, said broadcasting station including generating a control map defining the correspondence between said given URL and said given program ID, formatting said control map into said MPEG data packets, said method for displaying further comprising:

receiving said MPEG data packets including said control map; and
 selecting said program ID from said control map corresponding to said given URL.

12. A method in accordance with claim 11, wherein said control map further comprises a first table and a second table, each of said plurality of MPEG data packets being identified by a respective packet identifier, said broadcasting station further transmitting said first table in an MPEG data packet corresponding to a predetermined packet identifier; and transmitting said second table in an MPEG data packet having a packet identifier specified in said first table said second table defining the correspondence between said given URL and said given program ID, said method for displaying further comprising:

receiving said first table in said MPEG data packet corresponding to said predetermined packet identifier;
 receiving said second table in said MPEG data packet having said packet identifier specified in said first table; and
 selecting at said set-top decoder, responsive to said second table, said given program ID.

13. A network method in accordance with claim 11, wherein said broadcast communication network includes a return path communication channel from said set-top decoder to said broadcasting station, and wherein said given World Wide Web page further contains a control icon corresponding to a change in running status of said MPEG streaming video, said method for displaying further comprising:

transmitting a request from said set-top decoder to said broadcasting station on said return path communication channel to change the running status of said MPEG streaming video;
 receiving a revised control map from said broadcasting station, said revised control map defining the correspondence between said given URL and said given program ID containing said MPEG streaming video having a changed running status, and
 selecting, responsive to said revised control map and responsive to said given URL, said program ID corresponding to said MPEG streaming video having a changed running status for display.

14. In a broadcast communication network including a broadcasting station for transmitting on a broadcast medium,

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and a set-top decoder coupled to said broadcast medium, said broadcasting station including an Internet access server for retrieving World Wide Web pages, wherein at least a given World Wide Web page contains a given URL corresponding to streaming video in a first data format, said broadcast communications network further including a multi-channel digital television signal, each program channel of said multi-channel digital television signal being identified by a respective program ID, an apparatus for displaying said given World Wide Web page containing said streaming video at said set-top decoder, said apparatus comprising:

means for receiving digital data in a standard Internet Protocol over the Internet, said digital data being derived from said given World Wide Web page associated with said streaming video;

means for dividing said digital data in said standard Internet Protocol into a plurality of digital data packets while preserving said standard Internet Protocol;

means for mapping said plurality of digital data packets to the MPEG data packets of an MPEG data stream;

means for storing said streaming video in said first data format corresponding to said given URL at said broadcasting station;

means for transcoding said streaming video from said first data format into an MPEG digital video format at said broadcasting station to form MPEG streaming video;

transmitting said MPEG data packets into said MPEG data stream over said broadcast communication network;

means for transmitting said MPEG streaming video in a given program ID of said multi-channel digital television signal over said broadcast communication network; and at said set-top decoder,

means for receiving said multi-channel digital television signal;

means for receiving said MPEG data stream containing said MPEG data packets and said plurality of digital data packets at said set-top decoder to recover said digital data in standard Internet Protocol;

means for displaying said digital data in standard Internet Protocol at said set-top decoder, said digital data corresponding to said given World Wide Web page containing said given URL;

means for selecting said given URL;

means for selecting, responsive to selection of said given URL, said given program ID corresponding to said MPEG streaming video; and

means for displaying said MPEG streaming video corresponding to said given program ID;

whereby said digital data corresponding to said given World Wide Web page is broadcast in said standard Internet Protocol format, and said streaming video portion corresponding to said given World Wide Web page is broadcast in said MPEG digital video format.

15. A network apparatus in accordance with claim 14, wherein said multi-channel digital television signal is formatted into a plurality of MPEG data packets, said apparatus further comprising:

means for generating a control map defining the correspondence between said given URL and said given program ID;

means for formatting said control map into said MPEG data packets; and at said set-top decoder,

means for receiving said MPEG data packets including said control map; and

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means for selecting said program ID from said control map corresponding to said given URL.

16. A network apparatus in accordance with claim 15, wherein said control map further comprises a first table and a second table, each of said plurality of MPEG

data packets being identified by a respective packet identifier, said apparatus further comprising:

means for transmitting said first table in an MPEG data packet corresponding to a predetermined packet identifier; and

means for transmitting said second table in an MPEG data packet having a packet identifier specified in said first table said second table defining the correspondence between said given URL and said given program ID.

17. A network apparatus in accordance with claim 16, further comprising:

means for receiving said first table in said MPEG data packet corresponding to said predetermined packet identifier;

means for receiving said second table in said MPEG data packet having said packet identifier specified in said first table; and

means for selecting at said set-top decoder, responsive to said second table, said given program ID.

18. A network apparatus in accordance with claim 15, wherein said broadcast communication network includes a return path communication channel from said set-top decoder to said broadcasting station, and wherein said given World Wide Web page further contains a control icon corresponding to a change in running status of said MPEG streaming video, said apparatus further comprising:

means for transmitting a request from said set-top decoder to said broadcasting station on said return path communication channel to change the running status of said MPEG streaming video;

means for generating a revised control map at said broadcasting station, said revised control map defining the correspondence between said given URL and said given program ID containing said MPEG streaming video having a changed running status;

means for formatting said revised control map into said MPEG data packets; and at said set-top decoder,

means for receiving said MPEG data packets including said revised control map; and

means for selecting, responsive to said revised control map and responsive to said given URL, said program ID corresponding to said MPEG streaming video having a changed running status for display.

19. In a broadcast communication network including a broadcasting station for transmitting on a broadcast medium, and a set-top decoder coupled to said broadcast medium, said broadcasting station including an Internet access server for retrieving World Wide Web pages, wherein at least given World Wide Web page contains a given URL corresponding to streaming video in a first data format, said broadcast communications network further including a multi-channel digital television signal, each program channel of said multi-channel digital television signal being identified by a respective program ID, an apparatus for transmitting said given World Wide Web page containing said streaming video to said set-top decoder, said transmitting apparatus comprising:

means for receiving digital data in a standard Internet Protocol over the Internet, said digital data being derived from said given World Wide Web page associated with said streaming video;

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means for dividing said digital data in said standard Internet Protocol into a plurality of digital data packets while preserving said standard Internet Protocol;

means for mapping said plurality of digital data packets to the MPEG data packets of an MPEG data stream;

means for storing said streaming video in said first data format corresponding to said given URL at said broadcasting station;

means for transcoding said streaming video from said first data format into an MPEG digital video format at said broadcasting station to form MPEG streaming video;

means for transmitting said MPEG data packets in said MPEG data stream over said broadcast communication network; and

means for transmitting said MPEG streaming video in said MPEG digital video format in a given program ID of said multi-channel digital television signal over said broadcast communication network to said set-top decoder.

20. A transmitting apparatus in accordance with claim 19, wherein said multi-channel digital television signal is formatted into a plurality of MPEG data packets said transmitting apparatus further comprising

means for generating a control map defining the correspondence between said given URL and said given program ID; and

means for formatting said control map into said MPEG data packets.

21. A transmitting apparatus in accordance with claim 20, wherein said control map further comprises a first table and a second table, each of said plurality of MPEG data packets being identified by a respective packet identifier, said transmitting apparatus further comprising:

means for transmitting said first table in an MPEG data packet corresponding to a predetermined packet identifier; and

means for transmitting said second table in an MPEG data packet having a packet identifier specified in said first table said second table defining the correspondence between said given URL and said given program ID.

22. A transmitting apparatus in accordance with claim 20, wherein said broadcast communication network includes a return path communication channel from said set-top decoder to said broadcasting station, and wherein said given World Wide Web page further contains a control icon corresponding to a change in running status of said MPEG streaming video, said transmitting apparatus further comprising:

means for receiving a request from said set-top decoder to said broadcasting station on said return path communication channel to change the running status of said MPEG streaming video;

means for generating a revised control map at said broadcasting station, said revised control map defining the correspondence between said given URL and said given program ID containing said MPEG streaming video having a changed running status;

means for formatting said revised control map into said MPEG data packets; and

means for transmitting said MPEG data packets including said revised control map to said set-top decoder.

23. In a broadcast communication network including a broadcasting station for transmitting on a broadcast medium, and a set-top decoder coupled to said broadcast medium, said broadcasting station including an Internet access server for retrieving World Wide Web pages, wherein at least a given World Wide Web page contains a given URL corre-

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sponding to streaming video in a first data format, said broadcast communications network further including a multi-channel digital television signal, each program channel of said multi-channel digital television signal being identified by a respective program ID, said broadcasting station including means for receiving digital data in a standard Internet Protocol over the Internet, said digital data being derived from said given World Wide Web page associated with said streaming video, means for dividing said digital data in said standard Internet Protocol into a plurality of digital data packets while preserving said standard Internet Protocol, means for mapping said plurality of digital data packets to the MPEG data packets of an MPEG data stream, means for storing said streaming video in said first data format corresponding to said given URL at said broadcasting station, means for transcoding said streaming video from said first data format into an MPEG digital video format at said broadcasting station to form MPEG streaming video, means for transmitting said MPEG data packets in said MPEG data stream over said broadcast communication network, and

means for transmitting said MPEG streaming video in a given program ID of said multi-channel digital television signal over said broadcast communication network; and at said set-top decoder, an apparatus for displaying said streaming video at said set-top decoder comprising:

means for receiving said multi-channel digital television signal;

means for receiving said MPEG data stream containing said MPEG data packets and said plurality of digital data packets at said set-top decoder to recover said digital data in standard Internet Protocol;

means for displaying said digital data in standard Internet Protocol at said set-top decoder, said digital data corresponding to said given World Wide Web page containing said given URL;

means for selecting said given URL;

means for selecting, responsive to selection of said given URL, said given program ID corresponding to said MPEG streaming video; and

means for displaying said MPEG streaming video corresponding to said given program ID,

whereby said digital data corresponding to said given World Wide Web page is received in said standard Internet Protocol format, and said streaming video portion corresponding to said given World Wide Web page is received in said MPEG digital video format.

24. An apparatus in accordance with claim 23, wherein said multi-channel digital television signal is formatted into a plurality of MPEG data packets, said broadcasting station

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including means for generating a control map defining the correspondence between said given URL and said given program ID, means for formatting said control map into said MPEG data packets, said apparatus for displaying further comprising:

means for receiving said MPEG data packets including said control map; and

means for selecting said program ID from said control map corresponding to said given URL.

25. An apparatus in accordance with claim 24, wherein said control map further comprises a first table and a second table, each of said plurality of MPEG data packets being identified by a respective packet identifier, said broadcasting station further transmitting said first table in an MPEG data packet corresponding to a predetermined packet identifier; and transmitting said second table in an MPEG data packet having a packet identifier specified in said first table said second table defining the correspondence

between said given URL and said given program ID, said apparatus for displaying further comprising:

means for receiving said first table in said MPEG data packet corresponding to said predetermined packet identifier;

means for receiving said second table in said MPEG data packet having said packet identifier specified in said first table; and

means for selecting at said set-top decoder, responsive to said second table, said given program ID.

26. A network apparatus in accordance with claim 24, wherein said broadcast communication network includes a return path communication channel from said set-top decoder to said broadcasting station, and wherein said given World Wide Web page further contains a control icon corresponding to a change in running status of said MPEG streaming video, said apparatus for displaying further comprising:

means for transmitting a request from said set-top decoder to said broadcasting station on said return path communication channel to change the running status of said MPEG streaming video;

means for receiving a revised control map from said broadcasting station, said revised control map defining the correspondence between said given URL and said given program ID containing said MPEG streaming video having a changed running status, and

means for selecting, responsive to said revised control map and responsive to said given URL, said program ID corresponding to said MPEG streaming video having a changed running status for display.

* * * * *



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(45) **Date of Patent:** **Mar. 15, 2005**

(54) **METHOD FOR CACHING OF MEDIA FILES
TO REDUCE DELIVERY COST**

FOREIGN PATENT DOCUMENTS

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 626 days.

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(21) Appl. No.: **09/633,722**

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(22) Filed: **Aug. 7, 2000**

Related U.S. Application Data

(60) Provisional application No. 60/147,569, filed on Aug. 6, 1999.

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(51) Int. Cl.⁷ **G06F 15/16; H04N 7/173**

(List continued on next page.)

(52) U.S. Cl. **709/231; 725/93**

(58) Field of Search **709/203, 217,**
709/226, 231, 235; 725/87, 90, 91, 92,
93, 97, 101, 103

Primary Examiner—William Cuchlinski, Jr.

Assistant Examiner—Yemane M. Gerezgiher

(74) *Attorney, Agent, or Firm*—Quarles & Brady LLP

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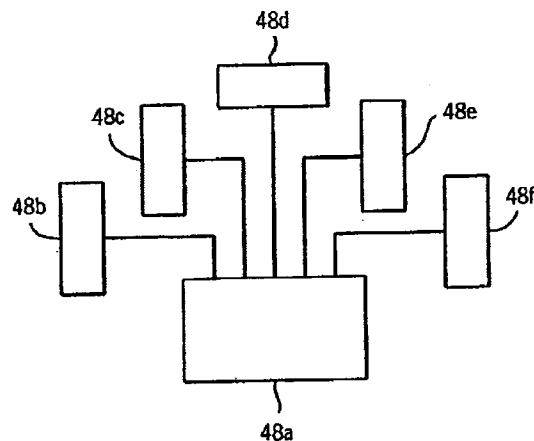
ABSTRACT

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Improvement on delivery of continuous media programs, such as video, divides the programs into prefixes and suffixes of data. One of these groups, or other groups associated with alternate on-demand data streaming, may be stored at a remote location, while the other of the groups may be stored at a plurality of regional locations. Accordingly, when the media program is ordered by a plurality of clients, a portion of the program will be broadcast from the regional server, while the other portion of the program will be transmitted from the remote server. The prefixes and suffixes are chosen so as to maximize the efficiency of data transfer taking into account the cost of storing the data as well as bandwidth costs.

20 Claims, 3 Drawing Sheets



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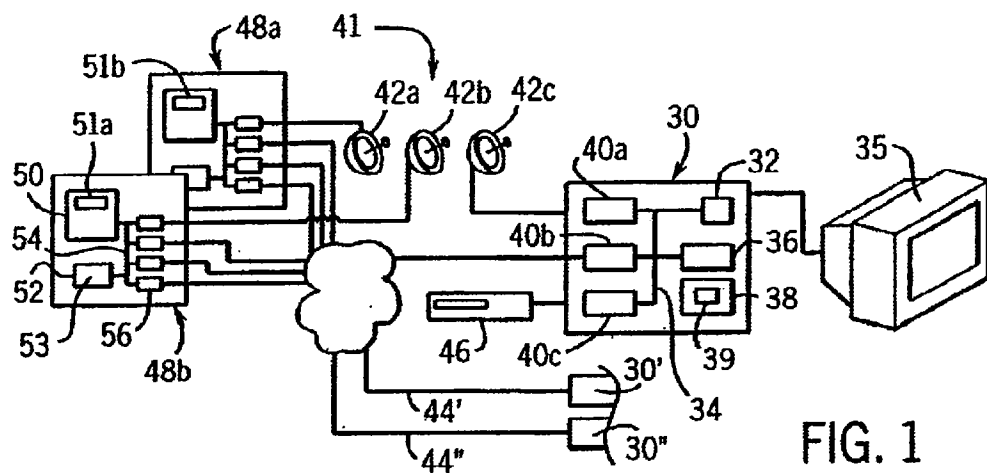


FIG. 1

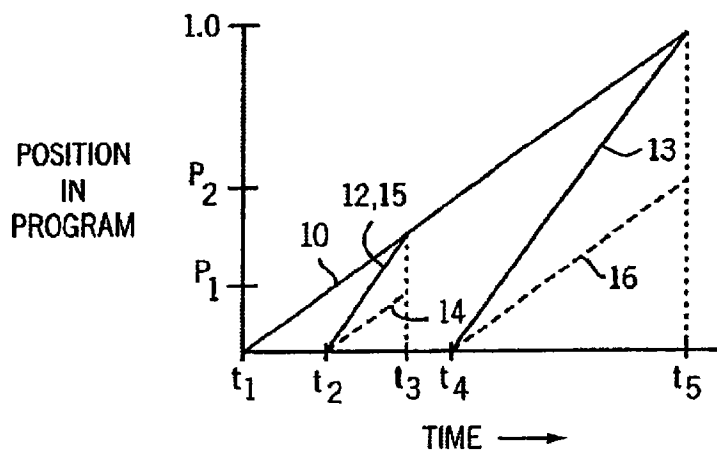


FIG. 2
PRIOR ART

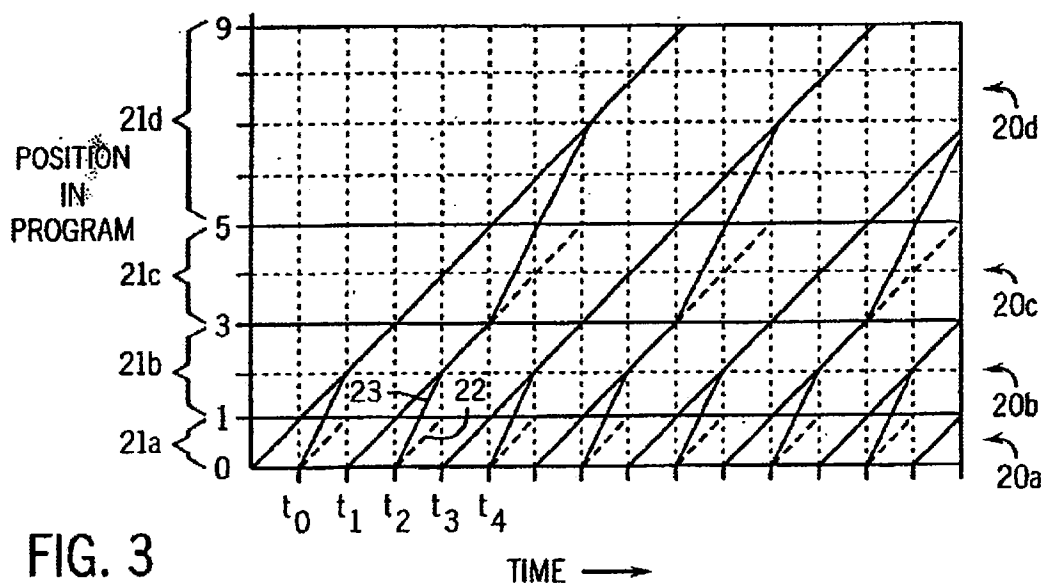


FIG. 3
PRIOR ART

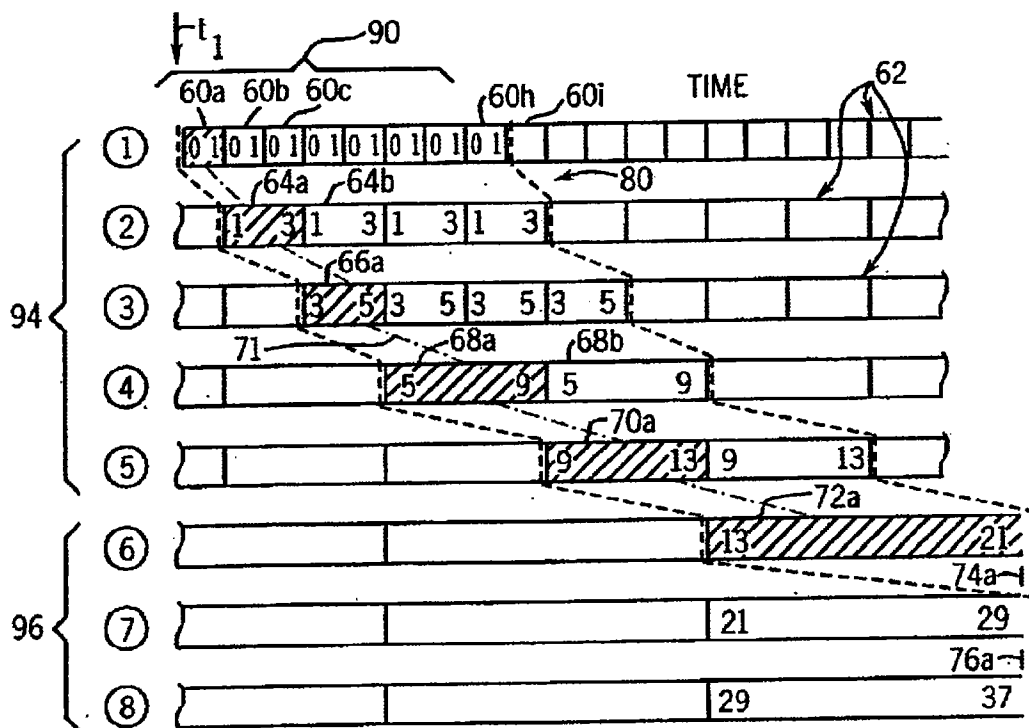


FIG. 4

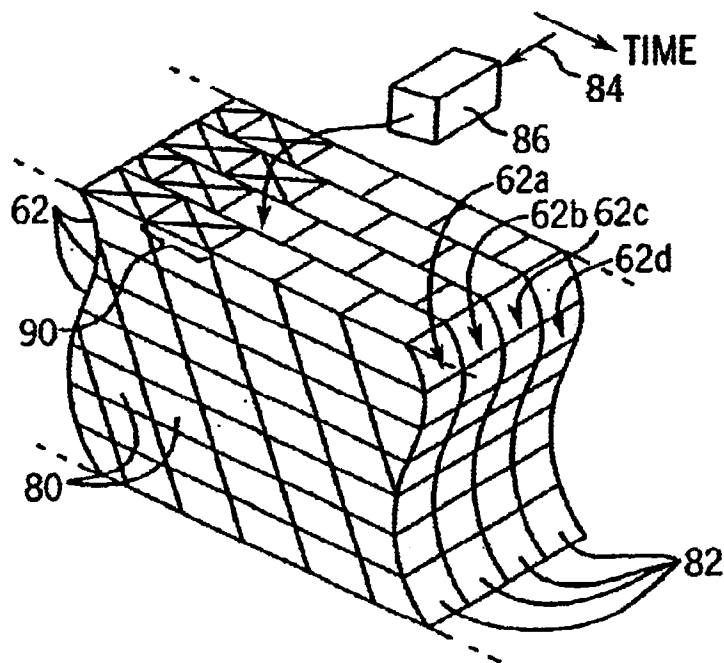


FIG. 5

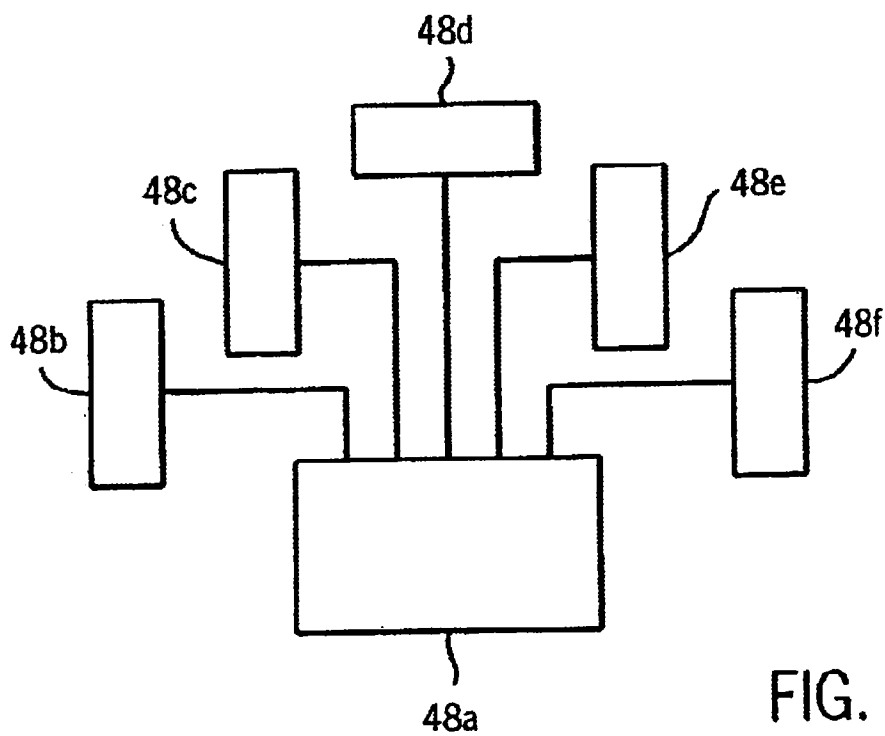


FIG. 6

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METHOD FOR CACHING OF MEDIA FILES TO REDUCE DELIVERY COST

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is based on provisional application 60/147,569 filed Aug. 6, 1999 and claims the benefit thereof

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

This invention was made with the United States government support awarded by the following agencies:

NSF3 9975044

The United States has certain rights in this invention.

BACKGROUND OF THE INVENTION

The present invention relates to methods of transmitting "streaming data", such as video or audio content, to multiple clients. In particular, the present invention provides a method of reducing the delivery costs associated with transmitting such data by selectively caching some of the content at regional servers close to the clients.

"Streaming data" is data that a client will process sequentially as it is received during a transmission, under a time-liness constraint requiring a minimum rate of progress in the reception of the data.

Examples of continuous media programs are video and audio programs, including movies, television shows, news clips, product advertisements, medical or recreational information or educational programs. This list of examples is not exhaustive.

"On-demand delivery" of streaming data is the delivery of streaming data triggered by client requests for that data, rather than simply by reaching a previously defined point in time. For example, in a video on-demand (VOD) system a customer might be able to request a video program at any time, with the expectation that the video would be viewable within a small time following the request.

Programs of streaming data may be stored at and transmitted from a server to clients via phone lines, cable, broadcast radio, satellite links or other media. The server may be a single machine or a set of machines that together provide a service.

For popular programs, many new requests may arrive at the server during a delivery period. In response to these requests, the server may make a separate transmission of data to each consumer. This approach is simple and works with standard receiving devices (e.g., television sets) but has the disadvantage of requiring a large number of transmission channels, one for each starting time where a request has been received. For this simple scheme, the bandwidth (e.g., number of channels) required to serve requests increases linearly with the number of starting times required and thus does not scale well to large numbers of starting times where requests will be received.

In order to reduce the bandwidth used to transmit the popular programs, the server might employ one of the multicast transmission methods described below. A key observation about each of these multicast methods is that if the program is popular, the server transmits earlier portions of each popular program more frequently than later portions of the program.

Piggybacking

Referring to FIG. 2, the transmission of each data stream describes a line on a graph plotting sequential position in the

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data stream (for example a frame number in a video transmission) against time. Sequential position as shown varies between zero and one where one indicates completion of the data stream.

A primary data stream **10** requested at delivery time t_1 is multicast at some base rate (indicated by the slope of the line extending from time t_1) that allows the client to view the data without interruption once playback begins.

At a later time t_2 the server may receive a second request for the same program. Instead of transmitting an entirely new data stream, the technique of piggybacking responds to this second request by transmitting an accelerated data stream **12**. This accelerated data stream is actually a different encoding of the program, such that the slightly fewer frames are created for each minute of the program. Data stream **12** delivers the same number of frames per minute as stream **10** but because these frames cover more than one minute of the program, the client receiving stream **12** progresses through the program at a rate that is imperceptibly faster (e.g., 5% faster) than the client who receives simple data stream **10**. As a result of these differences in viewing rate, the data streams **10** and **12** will intersect at time t_3 and the accelerated data stream **12** may terminate, saving the bandwidth that would have been required for its continuation. After data streams **10** and **12** have merged, the continuation of stream **10** can be merged with an earlier or later stream for the same program, by accelerating stream **10** or by accelerating the later stream, respectively.

Skyscraper Broadcasts

Referring to FIG. 3, a second way of multicasting streaming data divides the program into a plurality of "channels" **20a** through **20d** with each successive channel repeatedly transmitting a different time segment **21a-21d** of the program. Thus, for example, channel **20a** represented by a row of the chart of FIG. 3 may repeatedly transmit the first one-minute of the program, thus, from zero to one minute. Channel **20b** in contrast may repeatedly transmit from minutes 2 and 3 of the program while channel **20c** may transmit minutes 4 and 5 of the program, each of channels **20b** and **20c** repeating their segment on a two-minute basis. Channel **20d** may transmit minutes 6-9.

Under this system, a client wishing to receive the program at time t_1 waits until the next delivery time on an even minute increment (i.e., t_2) and then listen to channel **20a** to receive the first minute of the program indicated by stream **22**. The client's receiver begins displaying that first minute and simultaneously records channel **20b** providing segment **21b** of minutes 1-3 of the program. At the conclusion of the stream **22** at time t_3 , the client's receiver begins playing the previously recorded portions of stream **24** of segment **21b** at its beginning while continuing to record segment **21b** on channel **20b**. At time t_4 , one minute later, the client's receiver begins recording channel **20d** in preparation for the termination of the segment on channel **20c** two minutes later. In this way, by simultaneously recording and playing different channels, a continuous program may be assembled starting at any even minute interval. This method is termed "skyscraper broadcasts" referring generally to the way the complete program is assembled from segments of different sizes which when stacked like blocks from smallest to largest resemble the profile of a sky scraper.

It can be seen from this simple example that with skyscraper broadcasts, four channels may provide a nine-minute program starting every minute. If separate data streams were used for each new start time, nine channels would be

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required so it is apparent that skyscraping can significantly reduce the bandwidth required for regular transmissions. It should be appreciated that the bandwidth savings is even greater for longer running programs; for example, a two-hour movie can start every minute using just 12 skyscraper channels (with the number of minutes delivered on each channel having the pattern 1,2,2,4,4,8,8, . . .), rather than the 120 channels that would be required if a separate data stream were used for each new start time.

Dynamic Skyscraper Broadcasts

When multiple programs must be delivered, a variation on the skyscraper broadcast system termed "dynamic skyscraping" may be used to provide even greater transmission efficiencies. Dynamic skyscraping recognizes that the segment transmissions distributed among different channels for a given program may be organized into clusters that form a complete program thread with a given transmission of the last program segment on the final channel (i.e., on channel 20d in FIG. 3). For example, in FIG. 3, all segment transmissions that would be received by clients arriving between time 0 and time t_2 form a cluster. The boundary of a cluster exhibits the general merging that occurs in skyscraping where many multicasts of earlier data segments ultimately merge to a single stream represented by the final segment in the final channel of the transmission.

A significance of clusters is that once a first segment transmission of a cluster begins on the first channel, later requests for start times within the cluster do not require additional delivery of the final segment. Thus each cluster represents a single complete showing of the program and the next cluster represents a new showing.

Dynamic skyscraping recognizes that at the interface between clusters, program material may be readily changed and exploits this fact when multiple programs are being transmitted, by sharing uncommitted clusters among programs. Specifically, a number of transmission channels are organized into blocks, with each block dedicated to delivering skyscraper clusters. The clusters in the different blocks may be staggered in starting times. As requests for particular programs come in, they are assigned on a first-come, first-serve basis, first to any existing cluster currently transmitting the desired program and, if there are none, to any available cluster that has not previously been assigned. In this way, the clusters in each block of channels are assigned to programs in response to client requests, rather than being dedicated to a particular program. The staggering maximizes the availability of unassigned clusters and reduces the maximum waiting time when clusters are not available.

Patching

Patching, like the skyscraper technique, assumes that the client receiver may simultaneously store and playback portions of the program and may follow a given storage and playback scheme. The technique of will be explained by referring again to FIG. 2.

Again assume a primary data stream 10 is requested by a first client at delivery time t_1 and delivered at a rate equal to the rate at which the client reviews the primary data stream 10. A request for the same program by a second client at time t_2 causes the allocation of a second data stream 14 having the same data rate as primary data stream 10 but starting at time t_2 from the beginning of the program.

At time t_2 the second client receiver also begins recording the ongoing transmission of the primary data stream 10 from stream position p_1 . The receiver is thus receiving data at a

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higher rate of a composite data stream 15 equal to the sum of the rates of the data streams 10 and 14. This composite stream merges with the primary data stream 10 at time t_3 at which time data stream 14 (being part of composite data stream 15) may be terminated saving the bandwidth that would have been required if data stream 14 had continued for the length of the program without an attendant time distortion.

At a fourth time t_4 , a third client may request the media stream and composite data stream 13 may be created from the ongoing primary data stream 10 and a new data stream 16. This composite data stream 13 then merges with primary data stream 10 and data stream 16 is terminated. Additional client requests may be accommodated in this manner until the time when a composite data stream will no longer be able to merge with the primary data stream 10 before its conclusion, at which time a new primary data stream 10 is started. (Additionally, variants of patching may start a new primary stream for a client that could merge with an existing primary, as a performance optimization.)

Regional Caching

Any given server that may transmit streaming data to many clients may become overloaded if the client population becomes very large. Furthermore, the transmission medium used to transmit the data from the server to the clients may not have sufficient bandwidth to accommodate all of the transmissions that clients request. To alleviate these problems, or to otherwise improve the service to clients, a given program may be stored (i.e., cached) at another server, hereafter termed a "regional server", that handles some of the requests from a collection of clients. Typically the regional server is located closer to the clients than the original server, hereafter referred to as the "remote server". If the regional server has cached the program requested by a client, the regional server may either transmit the program to the client, or alternatively, may forward the client request to the remote server or to another server that can deliver the program to the client.

BRIEF SUMMARY OF THE INVENTION

The present invention provides streaming data caching methods that provide better service to clients (e.g., reduced delivery cost or reduced load on the remote server) than that of previously existing approaches, when some of those streaming data programs are delivered using multicast stream merging and are requested frequently enough for stream merging to occur.

The present inventors have recognized that when multicast stream merging is employed, the server transmits a unit of data (e.g., a video frame) that occurs earlier in the program more frequently than a same sized unit of data (e.g., another frame) that occurs later in the program. It is also recognized that the unit of data that occurs later in the program has more clients receiving each transmission of the data unit, on average, than the unit of data that occurs earlier in the program. The number of clients listening to a transmission, on average, will also increase if the server has a bigger client population for the program. Accordingly, it has been determined that in some cases it is desirable to break a program into a smaller prefix and the remaining larger suffix, and to allocate the prefix to one or more regional servers to improve service to clients, while allocating the suffix to the remote server to reduce storage costs and improve client cost-sharing.

In accordance with a first aspect of the invention, a method is provided for improving the efficiency of trans-

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mitting a streaming data program on-demand to multiple consumers in response to requests for the data. The program data is split into a prefix and suffix as a function of at least 1) costs associated with storing the prefix at a regional storage location and 2) costs of transmitting the suffix from the remote storage-location. Either the prefix or the suffix may be empty. The prefix is stored in the regional storage location, and the suffix is stored in the remote storage location.

In accordance with another aspect of the invention, it is appreciated that a given regional server may have a limited amount of cache storage space. When it is desired to have the capability of transmitting a plurality of media programs on-demand, the data comprising these programs may be divided and allocated to the regional and remote servers. It is appreciated that some media files will be more popular than others and, accordingly, in some cases it is desirable to store larger portions of less popular programs regionally so as to reduce the bandwidth costs associated with the transmission of these programs, realizing that the bandwidth cost associated with sending a program from the remote server to only a few clients may be the same as the bandwidth cost for sending the same program to a multitude of clients. When regional cache storage space is limited, it will often be more cost effective to store an initial prefix of many of the more popular programs as compared with storing fewer of the more popular entire programs that can fit in the cache. The suffixes of the more popular programs may then be cached at the remote server.

In accordance with yet another aspect of the invention, an optimization model minimizes a specified modifiable delivery cost function over a set of possible selections of program data that could be stored in each regional server cache. Accordingly, the possible selections of program data that can be stored at each regional server are any collection of program prefixes and entire programs, such that the prefixes are all of a specified size and the collection of prefixes and entire programs fits in the regional storage space.

The foregoing may not apply to all embodiments of the inventions and is not intended to define the scope of the invention, for which purpose claims are provided. In the following description, reference is made to the accompanying drawings, which form a part hereof, and in which there is shown by way of illustration, and not by way of limitation, a preferred embodiment of the invention. Such embodiment also does not define the scope of the invention and reference must be made therefore to the claims for this purpose.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a multicast transmission system and receiving systems suitable for practice of the present invention showing connections of a remote and regional server through a variety of links to each other and to a representative one of multiple consumers;

FIG. 2 is a graph plotting program position vs. time for transmissions under the prior art patching and piggybacking techniques as described above;

FIG. 3 is a graph similar to that of FIG. 2 showing the prior art technique of skyscraper broadcasts described above;

FIG. 4 is a graphical representation of a skyscraper delivery system in accordance with the preferred embodiment showing different channels on the vertical axis and time on the horizontal axis and further showing the breaking up of a continuous media program into multiple segments distributed over different channels which may assembled

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into program threads to recreate the entire continuous media program, each program thread tying within a given cluster, and wherein the multiple segments are broken up into a prefix and a suffix;

FIG. 5 is a three-dimensional perspective view of implementation of the skyscraper delivery system of FIG. 4 for multiple blocks, each which may hold a different program showing a persistent staggering of the clusters of the blocks to facilitate the allocation of new requests to clusters on a real-time basis; and

FIG. 6 is a schematic diagram of a remote server in communication with a plurality of regional servers.

DETAILED DESCRIPTION OF THE INVENTION

A. Technique for Video-On-Demand

The example of video-on-demand will be described, it being understood that the invention applies also to other types of streaming data. Further, the invention will be described with respect to a remote and regional server coordinating to deliver the video program. It should be recognized that the term "video program" as used herein is intended to be inclusive of a variety of circumstances, including, for example, an independent entity such as a movie or television show, a piece of a more complex multimedia presentation, or a single layer of a program that has been encoded using base and enhancement layers".

Referring now to FIG. 1, a consumer receiver 30, such as a set-top box at a consumer's home, connects via an output port 32 with a television monitor 35 through which a consumer may view streamed video data.

Output port 32 receives data by an internal bus 34 from a processor 36 that may execute a stored receiver program 39 (as will be described below) contained in memory 38 also connected to the internal bus 34. The internal bus 34 also connects to one or more input/output ("I/O") ports 40a through 40c which may provide for the receipt of streaming data I/O port 40a through 40c may be connected, for example, singly or multiply to any of a variety of transmission media 41 including satellite antenna 42a-c, ground line 44 such as telephone line or cable, or to a fixed media player 46, any of which may provide for one or more data streams.

A regional server 48b holds a portion 51a of a video program in memory 50 which will be formatted into data streams by processor 52 executing a stored server program 53 (described below) also stored in memory 50. The processor 52 and memory 50 communicate with each other over an internal bus 54 and also with multiple I/O ports 56 which may communicate via the previously described transmission media 41 and devices to multiple receivers 30, 30' and 30".

The particular communication protocols between the regional server 48b and the receivers 30 are not critical provided they allow for broadcasting or multicasting in multiple logical channels (which may but need not be physical channels). Additionally, FIG. 1 shows the end points of the transmission as the server and the client viewer. However, the transmission techniques could be used in other places. For example, the "client end" could be a regional proxy, or simply a machine that processes but does not display the material. Similarly, the server end could be a regional proxy that doesn't store the entire video at any point in time (if, for example, it itself is receiving it from somewhere).

Regional server 48b may be connected with remote server 48a of identical design holding in memory 51b other portions of the video program and communicating them either to server 48b or directly to consumer receiver 30 as will be described.

The preferred embodiment of the invention improves over a prior art formatting technique termed "dynamic skyscraping" described in a paper by the present inventors entitled Dynamic Skyscraper Broadcast for Video-On-Demand, presented at the Fourth International Workshop on Multimedia Information Systems (MIS'98), Istanbul, Turkey, September 1998, by Derek L. Eager and Mary K. Vernon.

Referring to FIG. 4, in this technique, a video program is broken into a variety of segments 60, 64, 66, 68, 70, 72, 74, and 76 of progressively greater length. A variety of different sequences of segments may be used but, in the present example, the sequence of relative sizes is [1,2,2,4,4,8,8], that is segments 64 and 66 are twice as long as segment 60, segments 68 and 70 are four times as long as segment 60 and so forth.

Each segment is repeatedly broadcast on a different channel 62. Thus, the first segment 60 is repeatedly broadcast on a first channel 62 and spans, for example, the first minute of video data from start to minute one as indicated. At the conclusion of the broadcast of one segment 60*a*, it is repeated or another segment of similar size broadcast in its place (as segments 60*b*, 60*c* and so forth).

The second segment 64*a* comprising the next two minutes of broadcast video (i.e., from minutes one to three) is broadcast on a second channel 62. This segment 64 is also repeated (as segments 64*b*, 64*c*, and so forth) with the boundaries between segments 64 aligned with every other boundary between segments 60. The third segment 66*a* may hold minutes three to five, and is repeated (as segments 66*b*, 66*c*, and so forth) on channel three with segments 66 aligned with segment 64.

The fourth channel may be used to broadcast segment 68*a* holding minutes five through nine repeated (as segments 68*b*, 68*c*, and so forth) with boundaries between segments 68 aligned with every other boundary between segments 66 (and 64). The fifth channel broadcasts segment 70*a* holding minutes nine through thirteen repeated (as segments 70*b*, 70*c*, and so forth) with boundaries between segments 70 aligned with segments 68.

Channels six, seven, and eight provide, respectively, minutes thirteen through twenty-one, via segments 72, minutes twenty-one through twenty nine, via segments 74, and minutes twenty-nine through thirty-seven, via segments 76. The boundaries of each of these latter equal-sized segments are aligned with each other and with every other boundary between segments 68 of channel four.

Referring also to FIG. 1, a consumer requesting to view the program of the segments 60, 64, 66, 68, 70, 72, 74, and 76 at a time t_1 waits briefly for the beginning of segment 60*a* and begins playing the content of segment 60 on the television monitor 35 (shown in FIG. 1) as received from channel zero. At the conclusion of that segment 60*a*, the receiver 30 is programmed to switch to channel one to begin playing segment 64*a*. At conclusion of segment 64*a*, the receiver 30 switches to channel two and begins playing segment 66*a*. This process of switching channels is repeated to play segment 68*a*, 70*a*, 72*a*, 74*a*, and 76*a* and thus to play the entire program. The segments 60*a*, 64*a*, 66*a*, 68*a*, 70*a*, 72*a*, 74*a* and 76*a* make up a program thread 71 (indicated also by shading) which complete without gap a transmission of the program.

A similar program thread (not shaded) may be constructed starting at segment 60*b*. In this case, as segment 60*b* is played by the receiver 30, segment 64*a* is recorded or buffered into the receiver's memory 38. The buffering process then merges with the program thread 71 to follow the same sequence of segments as previously described

recording segments 66*a*, 68*a*, 70*a*, 72*a*, 74*a* and 76*a*, while the receiver 30 plays the video shortly behind its recording into memory 38.

The buffering allows different initial segments 60*a* through 60*h* to all serve requests from different consumers, and thus provide of the video program, and yet all to eventually merge with the final segment 76*a* for reduced bandwidth delivery. At most, only one channel must be buffered for any program thread.

As all program threads eventually merge at segments 76, a cluster 80 (bounded by dashed lines and only partially shown in FIG. 4) may be defined as the collection of all segments 60, 64, 66, 68, 70, 72, and 74 having one of segments 72 in common. As a general rule, once an individual first segment 60*a* of a cluster 80 is allocated, except for minor channel stealing as described above, the remaining segments 64, 66, 68, 70, 72 must be reserved for the given program because the threads of other segments of the cluster eventually merge. Nevertheless, a first segment 60*i* outside of the cluster 80 may be allocated to a different final segment 76.

Each cluster exhibits a catch-up window 90 equal generally to the time width of the segments 60*a* through 60*g* forming the top segment layer of the cluster 80. For a request to be serviced by a cluster that has already started, it must arrive at a time from the first segment 60*a* to immediately prior to the last segment 60*h*.

Referring now to FIG. 5, different sets of channels 62*a*, 62*b*, 62*c*, and 62*d* may be arranged in blocks 82 with a staggering in time of their respective clusters 80. As a given request 84 is received, an allocation routine 86 may review clusters 80 in any of the blocks 82 whose catch-up windows 90 embrace the request time.

If the client requests a program that is not currently allocated to a cluster 80, the next free cluster 80 is allocated to the requested program. Clusters 80 assigned to a program are identified in FIG. 5 by X's spanning the catch-up window 90 on the upper face of the clusters 80. Otherwise the client request is allocated to the existing cluster serving that program.

B. An Efficient Data Transfer Technique

In operation, it is recognized that a cost is associated with the storage of continuous media data. Typically, storage costs increase as the amount of stored data increases. There may also be costs associated with the transfer of the programs from the regional server 48*b* and remote server 48*a*, and in particular the cost to transmit data from the remote server may be greater than the cost to transmit the same data from the regional server. In this case, referring to FIG. 6, when multiple regional servers 48(*b-f*) are accessed by clients requesting that a media program be sent, a tradeoff exists between storing the program data at multiple regional servers and transmitting the data from the regional servers, and storing the data remotely, and transmitting the data from the remote server. While storing the data regionally will decrease the cost to transmit the data, the cost of storing the data at more than one regional server may negate the savings associated with the relatively low transmission costs. However, while storing the data remotely will reduce storage costs because the data need only be stored at one location, the savings from data storage may be negated by the costs associated with long distance data transmission.

The present inventors have recognized that in some cases, it is desirable to break the program data into two groups of data, a prefix and a suffix, to allow the storage and transmission burden of the channels to be divided among a regional server 48*b* and a remote server 48*a* per the channel

group interface 92. In the preferred embodiment of dynamic skyscraper delivery, this involves partitioning the data segments into a leading group of segments and a trailing group of segments, wherein leading group of segments will be allocated to the regional server 48b to reduce transmission cost, and the segments of the trailing group 96 will be allocated to the remote server 48a to reduce storage cost. The trailing group, as opposed to the leading group, is allocated to the remote server 48a because the cost of storing and transmitting the trailing groups at multiple regional servers is greater than the cost to store those groups remotely and transmit them via long distance in this example, as will be illustrated below with reference to Tables 1A and 1B. When the two groups of segments are allocated to different servers, the need for precise alignments between the channels of each group is relaxed so that delivery of the trailing group cluster can be scheduled earlier and buffered at the client to facilitate the switchover between the two transmission groups. For the purposes of illustration and clarity, the leading and trailing groups 94 and 96, respectively, are broken between the groups of the first three channels and next five data channels in accordance with the illustrated embodiment, as will now be described.

It should be appreciated that even though the remote server 48a is transmitting to the clients of five regional servers 48(b-f) as illustrated in FIG. 6, some of the transmissions will be shared multicasts, due to the multicast stream merging method in use.

The example may be simplified by assuming that storage and regional transmission costs are the same from one location to the next, and that remote transmission costs are constant regardless of the time of day. Additionally, the cost for transmitting the data from the remote server assumes any additional regional charges that may incur should the remote server 48a send the data to the given clients via a regional server for the client 48(b-f). Finally, for the purposes of this illustrative example, it will be assumed that the leading segment cluster has the same duration on each channel as the trailing segment cluster, as shown in FIG. 4, although more efficient delivery of the leading segment cluster is described in a co-pending patent application entitled "Method for Reduced Bandwidth for On-Demand Data Streaming Using Mini-Clusters" filed concurrently herewith, the disclosure of which is hereby incorporated by reference. It will become apparent to those having ordinary skill in the art that as these assumptions are negated, while the simplified example, described immediately below, becomes more complicated, the theory of operation, as will be explained in more detail below in section C, nonetheless remains valid.

In this simplified example, the storage cost for one minute of data (S) is \$0.02 for the length of the transmission cluster, the regional network bandwidth cost for one minute of data (T_L) is \$0.01, and the remote network bandwidth cost for one minute of data (T_R) is \$0.085. Again, it should be appreciated that these variables and corresponding values are being used to demonstrate the theory of the preferred embodiment only. As a result, to calculate the total cost to store and transmit a given set of program segments at a particular server, two primary costs will be involved: the cost to store the data, and the cost to transmit the data. The cost to store data for a given set of program segments is equal to the total size of the segments (B) times the storage cost, while the cost to transmit the data is equal to the total bandwidth used to transmit the segments during a cluster (TB) times the bandwidth cost. For example, for the first program segment to be broadcast by a given server, only one minute of data need be stored (B=1), however transmission

costs for 8 minutes total bandwidth are incurred for each cluster that is scheduled to deliver the program (TB=8), assuming that a sufficient frequency of client requests exist to necessitate all segment re-transmissions 60(a-h) in the channel. As illustrated in the cluster of FIG. 4, the total bandwidth (TB) per channel is 8 minutes in this instance of the preferred embodiment. The total cost of storing and transmitting data for all segments that are transmitted regionally are multiplied by the total number of regional servers (L).

Accordingly, the total cost to store and transmit the first segment of data locally (TC_L) may be represented by the following equation:

$$TC_L = L * [(S * B) + (TB * T_L)] \quad (1)$$

Therefore, the cost of storing and transmitting the first segment regionally is $5[($0.02 * 1) + (8 * $0.01)] = 0.50 . The total cost to store and transmit the first segment of data remotely (TC_R) may be represented by the following equation:

$$TC_R = [(S * B) + (TB * T_R)] \quad (2)$$

If segments 2-8 are stored and transmitted remotely, the cost is $[($0.02 * 36) + (56 * $0.085)] = 5.48 . The total cost (TC) for broadcasting the data file is therefore simply the summation $TC_L + TC_R$. The results for all possible combinations where the leading group is allocated to the regional servers, and the trailing group is allocated to the remote server are illustrated below in Table 1A.

TABLE 1A

Segments transmitted regionally	Segments transmitted remotely	TCL	TCR	TC
0	1-8	\$0	\$6.18	\$6.18
1	2-8	\$0.5	\$5.48	\$5.98
1-2	3-8	\$1.10	\$4.76	\$5.86
1-3	4-8	\$1.70	\$4.04	\$5.74
1-4	5-8	\$2.50	\$3.28	\$5.78
1-5	6-8	\$3.30	\$2.52	\$5.82
1-6	7-8	\$4.50	\$1.68	\$6.18
1-7	8	\$5.70	\$0.84	\$6.54
1-8	0	\$6.90	0	\$6.90

Table 1B illustrates the increased costs when trailing, as opposed to leading, data is allocated to the regional servers, and leading data is allocated to the remote servers. These tables therefore provide an illustration of cost savings in allocating the leading data to the regional servers.

TABLE 1B

Channels broadcast locally	Channels broadcast remotely	TCL	TCR	TC
1-8	0	\$6.90	\$0	\$6.90
2-8	1	\$6.4	\$0.7	\$7.1
3-8	1-2	\$5.8	\$1.42	\$7.22
4-8	1-3	\$5.20	\$2.14	\$7.34
5-8	1-4	\$4.4	\$2.9	\$7.3
6-8	1-5	\$3.6	\$3.66	\$7.22
7-8	1-6	\$2.4	\$4.5	\$6.9
8	1-7	\$1.2	\$5.34	\$6.54
0	1-8	\$0	\$6.18	\$6.18

As was discussed above, efficiency of the data transmission is optimized when the leading group (or prefix) is allocated to the regional servers, and the trailing group (or suffix) is allocated to the remote server. More particularly, with reference to the present set of parameters, the best

prefix with respect to minimizing total delivery cost may be identified with reference to Table 1A as segments 1-3, while the suffix to be stored at the remote server comprises channels 4-8. Splitting the program data in this manner minimizes the cost incurred to transmit the entire file to a plurality of clients at a plurality of locations.

It should be appreciated that as a practical matter, cost may be incurred for storage at the remote server even when the data is also stored at all regional servers. Further, more, the remote and regional transmission costs might be based on relative demerits assigned for placing load on the remote server and network versus providing the corresponding transmission bandwidth at the regional server, respectively, to reflect the desirability versus cost of providing better service to clients by offloading the remote server. While the data may be different in these scenarios, an optimization is nonetheless attainable under the theory described above for a given number of regional servers. It should additionally be appreciated that storage costs may not always increase linearly with increasing amount of storage data, that transmission costs in general depend on the frequency of client requests, that storage costs generally occur over longer periods of time than the duration of a single dynamic skyscraper transmission cluster, and that a different stream merging method than dynamic skyscraping might be employed. In each of these scenarios the optimization is attainable using cost formulas that follow the same principles as the above and that can be derived by one having ordinary skill in the art. It should further be appreciated that, depending on the values of various parameters, the leading group 94 and trailing group 96 may be divided in different manners so as to optimize the efficiency of a given program and regional server on a case-by-case basis. Alternatively, the optimal break between the leading and trailing groups for a plurality of programs and regional servers could be determined to enable a general protocol for all programs, which would eliminate the need to determine the leading and trailing groups on a case-by-case basis.

In some cases, a predetermined amount of cache storage space will be available at some of the regional servers. In this case the optimal combination of program prefixes and full programs that should be stored at the regional server to minimize total transmission costs can be computed using similar principles to the principles in the simple example above. This will now be described in more detail below.

C. A Preferred Optimized Data Caching Technique

The above simplified example may be generalized using an optimization model for multiple programs that permits calculation of the collection of prefixes and full programs that should be cached at each regional (or proxy) server in order to minimize delivery cost for a given skyscraper configuration. For this purpose, the set of optimization model parameters will now be set forth and defined with reference to Table 2.

TABLE 2

Parameter Definition	
Input	
k	Number of segments in the leading segment set
K	Number of segments per object
N	Number of objects
N	Number of groups of skyscraper channels
N _{channels}	Maximum number of channels at each regional server
N _{segments}	Storage capacity(measured in number of unit-segments) at each regional server

TABLE 2-continued

Parameter Definition	
Output	
P	Number of regional servers
s _j	Size of the j'th segment (relative to the size of the first)
T ₁	Duration of a unit-segment transmission
W	The largest segment size in the leading segment set
W	The largest segment size in the trailing segment set
β	The cost of a regional server channel, relative to that of a remote server channel
λ _i	The cost of a regional server channel, relative to that of a remote server channel total arrival rate of request for object i
C	total number of channels devoted to skyscraper multicasts
C _{remote}	number of channels needed for remote server multicasts
C _{regional}	number of channels needed for regional server multicasts
D _{regional}	storage needed at each regional server, in number of unit-segments
X _i ^{1,R} , X _i ^{1,P} , X _i ^{1,r} , X _i ^{1,R} , X _i ^{1,r} , X _i ^{1,r}	maximum rate at which transmission clusters can be allocated for multicasts of the leading/trailing (l/t) segment set for object i, distinguished by whether the segments of the object are only stored at the remote server (R), are partially cached at the regional servers (p), or are fully cached at the regional servers (r)
θ _i ^R	equals 1 if object i is stored only at the remote server; 0 otherwise
θ _i ^P	equals 1 if only the leading segment set of object i is cached regionally; 0 otherwise
θ _i ^r	equals 1 if object i is entirely cached regionally; 0 otherwise

The estimate of required bandwidth is developed first for the simpler context of a dynamic skyscraper system that does not have regional servers and does not use mini-clusters to improve performance (i.e., k=0). Letting C*=K×N* denote the estimate of the required number of channels, and λ_i denote the rate of requests for object i, we obtain:

$$C^* = K \times N^* = K \times W T_1 \sum_{i=1}^n \frac{1}{\left((W-1) T_1 + \frac{1}{\lambda_i} \right)} \quad (3)$$

The factor WT₁ is the duration of a transmission cluster on each channel. The i'th term in the sum is the inverse of the average time between transmission clusters that deliver object i, assuming requests for a new transmission clusters have zero wait time (or an infinite number of channels are available), and assuming that the average arrival rate of requests for the object when a transmission cluster is not available for catch-up is equal to the overall average arrival rate. (Note that the latter assumption implies that 1/λ_i is the average time from the end of a transmission cluster catch-up window for object i until the next request for that object.) Thus, the i'th term gives the allocation rate for new transmission clusters for object i if an infinite number of channels is available. Summing over all objects that use skyscraper multicasts gives the total maximum allocation rate, and multiplying this maximum allocation rate by the duration of a transmission cluster gives the average number of groups of channels that would be in use if an infinite number of groups were available. Multiplication by the number of channels per group gives an estimate of the total number of channels that should be provided.

The specific optimization problem considered is that of determining the regional cache contents that minimize the overall cost of delivery, as represented by a weighted sum of the required number of channels at the remote server and at each regional server, subject to constraints on the bandwidth and storage capacity at each regional server.

The optimization model parameters are defined in Table 2. Outputs θ_i are the values that specify whether object i should be cached (fully or partially) at the regional servers.

It is assumed that all objects have the same segmentation parameters (K, W, k, w), and that each object can have O, k or K segments stored regionally. It is also assumed that the regional sites are homogeneous in storage and bandwidth capabilities, as well as in client request rates and object selection frequencies, and thus, that all of the regional servers will store the same segments/objects. These assumptions simplify the exploration of the system design space and are thus appropriate for gaining initial insights. The model can easily be modified to include more general formulations in the future.

With the above notation and assumptions, the optimization problem is formally described as follows:

$$\min_{\theta} C_{remote}(\theta) + P\beta C_{regional}(\theta)$$

$$\text{subject to } C_{regional}(\theta) \leq N_{channels}$$

$$D_{regional}(\theta) \leq N_{segments}$$

$$\theta_i^R, \theta_i^P, \theta_i^T, i=1, 2, \dots, n;$$

$$\theta_i^R, \theta_i^P, \theta_i^T \in \{0, 1\}, i=1, 2, \dots, n,$$

Here the notation θ represents the vector whose components $\theta_i^R, \theta_i^P, \theta_i^T, i=1, 2, \dots, n$.

Solution of this optimization model uses a method of computing the number of channels needed at the remote server as well as at each regional server, as a function of the client workload (i.e., request arrival rates for each object), the partitioned skyscraper configuration, and the object segments cached at the regional servers. To compute these channel estimates, we use the basic approach that was used in Section 4.1, entailing finding the maximum allocation rates of new (mini- and trailing segment) transmission clusters, assuming an infinite number of channels is available.

The maximum allocation rate for new transmission clusters in a system with no regional caching and no mini-clusters is the inverse of the average time between requests for a new transmission cluster when there is no queuing, as given by,

$$(W-1)T_1 + \frac{1}{\lambda_i}.$$

The maximum allocation rates for trailing segment set transmission clusters in the partitioned dynamic skyscraper architecture are given by similar expressions that depend on whether the transmission cluster is delivered by the remote (R) or regional (r) server. If the multicast uses mini-clusters of size k segments, the duration of the total catch-up window for trailing segment set clusters is

$$W - s_{k+1} + \sum_{j=1}^k s_j.$$

Noting that λ_i IP is the arrival rate of client requests for object i at a regional server, the maximum allocation rates for trailing segment set clusters are as follows:

$$X_i^{t,R} = X_i^{t,P} = \frac{1}{\left(W - s_k + 1 + \sum_{j=1}^k s_j\right)T_1 + \frac{1}{\lambda_i}} \quad (4)$$

$$X_i^{t,r} = \frac{1}{\left(W - s_k + 1 + \sum_{j=1}^k s_j\right)T_1 + \frac{P}{\lambda_i}} \quad (5)$$

The maximum allocation rates for mini-clusters are further complicated by the fact that the min-catch-up window for such a cluster has a variety of possible lengths, depending on when the mini-cluster begins in relationship to the end of the catch-up window of the corresponding trailing segment set transmission cluster. To compute the average catch-up window size for mini-clusters for object i , we make two assumptions. First, we assume that the average arrival rate of mini-cluster requests for object i during the last wT_1 of the catch-up window of an object i trailing segment set transmission cluster is equal to the overall average arrival rate of mini-cluster requests for that object. This implies that the fraction of mini-clusters for object i that will begin during this time period is given by wT_1 times the allocation rate of object i trailing segment set transmission clusters. Second, we assume that such arrivals may occur anywhere within this time period with equal probability. Thus, the average catch-up window size of the corresponding mini-clusters is given

$$\frac{w-1}{2}T_1.$$

All other mini-clusters have a full catch-up window of size $(w-1)T_1$. The three mini-cluster allocation rates are therefore given by

$$X_i^{t,r} = \frac{1}{\left(X_i^{t,r}wT_1\frac{w-1}{2} + (1 - X_i^{t,r}wT_1)(w-1)\right)T_1 + \frac{P}{\lambda_i}} \quad (6)$$

the following equations.

$$X_i^{t,P} = \frac{1}{\left(X_i^{t,P}wT_1\frac{w-1}{2} + (1 - X_i^{t,P}wT_1)(w-1)\right)T_1 + \frac{P}{\lambda_i}} \quad (7)$$

$$X_i^{t,R} = \frac{1}{\left(X_i^{t,R}wT_1\frac{w-1}{2} + (1 - X_i^{t,R}wT_1)(w-1)\right)T_1 + \frac{1}{\lambda_i}} \quad (8)$$

Multiplying each of the above allocation rates by the duration of, and number of channels in, a transmission cluster of the corresponding type, yields an estimate for the number of channels required for that particular type of transmission cluster. For specific object segment allocations, as reflected through the θ_i values, the required number of channels and regional storage can thus be computed as follows:

$$C_{remote}(\theta) = \sum_{i=1}^n (\theta_i^R X_i^{t,R} + \theta_i^P X_i^{t,P} (K-k)wT_1 + \theta_i^T X_i^{t,r} kwT_1) \quad (9)$$

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-continued

$$C_{regional}(\theta) = \sum_{i=1}^n \theta_i^r X_i^{r,R} + (K-k)WT_1 + \theta_i^r X_i^{r,R} + \theta_i^p X_i^{p,P} kW T_1 \quad (10)$$

$$D_{regional}(\theta) = \sum_{i=1}^n (\theta_i^r + \theta_i^p) \sum_{j=1}^k s_j + \theta_i^r \sum_{j=k+1}^K s_j. \quad (11)$$

The above equations estimate the required number of channels (or disk I/O and network I/O bandwidth) at each type of server, assuming the network supports multicast or broadcast delivery. This is also the number of network channels required for the remote (or regional) multicasts if the respective server is operating over a broadcast network such as a satellite or cable network. Recall that the required regional network bandwidth is not affected by whether the objects are stored at the remote or regional server. Thus the only extension that is needed to make the model precise for a switched network is to factor in the average remote network bandwidth required to multicast each object.

There are several points worth noting about the model. First, the model is valid for multiple remote servers if each stores a distinct subset of the objects in the system and if the network used by each remote server has the same cost for the same required bandwidth. In this case C_{remote} is the aggregate number of channels that must be provided at the collection of remote servers. Second, the model can be generalized for heterogeneous regional servers by developing separate calculations, similar to those given above, and summing over the appropriate objects, for each distinction regional server. Third, C_{remote} , $C_{regional}$, and $D_{regional}$ are linear functions of the binary variables θ . Thus, the optimization model is a mixed integer linear program (MIP), for which reliable solution techniques exist.

While the techniques described above have been illustrated in combination with the scyscraper merging technique, they may be easily implemented with other data transfer techniques. For example, in a patent application entitled "Method for On-Demand Data Streaming" filed concurrently herewith and hereby incorporated by reference, a data transfer technique is disclosed having a fixed or dynamic merger hierarchy. In particular, a first transmission of the streaming data file begins at a time of a first client request, a second transmission of the streaming data file begins at the time of a second client request, and a third transmission of the streaming data file begins at the time of a third client request during the first transmission. The second and third transmissions are merged with each other prior to their merger with the first transmission. The hierarchical data transfer technique may be desirable, for example, where a low number of client requests exist for a given streaming data file.

In this embodiment, a program prefix will be stored at each regional server, and the remaining suffix will be stored at the remote server. The size of the prefix will be determined based on the above-described principles described, as should be appreciated by one having ordinary skill in the art, as the local storage costs will be balanced against the long distance costs for transmitting the data. An improved, or alternatively optimal, determination of prefix size may then be achieved. Alternatively, the above model may be used to determine, given a plurality of regional servers having various storage capabilities, the desired amount of storage to improve, or optimize, cost efficiency.

It is specifically intended that the present invention not be limited to the embodiments and illustrations contained herein, but that modified forms of those embodiments

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including portions of the embodiments and combinations of elements of different embodiments also be included as come within the scope of the following claims.

We claim:

1. A method of improving an efficiency of transmitting a continuous media program on-demand to multiple consumers, wherein the media program is transmitted from at least one regional storage location serving a corresponding plurality of consumers and a remote storage location in communication with the at least one regional storage location, in response to a plurality of consumer requests, the method comprising:

- splitting the program into a prefix and a suffix as a function of at least 1) costs associated with storing the prefix at the at least one regional storage location and 2) costs of transmitting the suffix from the remote storage location;
- storing the prefix in the at least one regional storage location;
- storing the suffix in the remote storage location;
- transmitting the prefix to the plurality of consumers from the corresponding at least one regional storage location; and
- transmitting the suffix to the plurality of consumers from the remote storage location.

2. The method as recited in claim 1, further comprising transmitting the prefix and suffix continuously.

3. The method as recited in claim 2, wherein the prefix comprises a leading group of segments, and wherein the suffix comprises a trailing group of segments.

4. The method as recited in claim 3, wherein the prefix and suffix are chosen so as to reduce the combined storage and bandwidth costs associated with transmitting an entire given media program to the plurality of clients.

5. The method as recited in claim 4, wherein the prefix and suffix are chosen so as to average down the combined storage and bandwidth costs associated with transmitting a plurality of media programs to the plurality of clients.

6. The method of claim 1, wherein the continuous media program is transmitted in accordance with a skyscraper technique.

7. The method as recited in claim 1, wherein the prefix and suffix comprise a plurality of sequential segments of data.

8. The method as recited in claim 7, wherein the segments of the prefix are smaller than the segments of the suffix.

9. The method as recited in claim 1, wherein the media program may be transmitted via at least one of phone lines, cable systems, broadcast radio, and satellite links.

10. The method as recited in claim 1, wherein the prefix and suffix are further split as a function of costs associated with transmitting the prefix.

11. The method as recited in claim 1, wherein the prefix and suffix are further split as a function of costs associated with storing the suffix.

12. A method of reducing operation costs of an on-demand media file delivery system, wherein the media file is transmitted, from at least one of a plurality of regional storage locations and a remote storage location located remotely from the plurality of regional storage locations, in response to a plurality of client requests, the method comprising:

- splitting the media file into a fixed prefix and a fixed suffix;
- storing the prefix at the at least one regional storage location;
- storing the suffix at the remote storage location;

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- (d) transmitting the prefix to the plurality of clients from the at least one regional storage location; and
 (e) transmitting the suffix to the plurality of clients from the remote storage location.

13. The method as recited in claim 12, wherein the prefix and suffix are further determined so as to reduce the storage costs of the prefix, and to reduce the transmission costs of the suffix.

14. A method of improving an efficiency of transmitting a plurality of continuous media program on-demand to multiple consumers, wherein the media programs are transmitted from at least one regional server serving a corresponding plurality of consumers and a remote server in communication with the at least one regional server, in response to a plurality of consumer requests, the method comprising:

- (a) splitting the programs into prefixes and a suffixes as a function of at least 1) costs associated with storing the prefixes at the at least one regional storage location and 2) costs of transmitting the suffix from the remote storage location;
 (b) storing some of the prefixes in the at least one regional server;
 (c) storing some of the suffixes in the remote server;
 (d) transmitting the prefix of a requested media program to a plurality of requesting consumers from the corresponding at least one regional server; and
 (e) transmitting the suffix of the requested media program to the plurality of requesting consumers from the remote server.

15. The method as recited in claim 14, wherein the prefix of the requested media program is empty, and the suffix comprises the entire media program.

16. The method as recited in claim 14, wherein the suffix of the requested media program is empty, and the prefix comprises the entire media program.

17. The method as recited in claim 14, wherein the prefixes and suffixes are determined for the plurality of media programs based at least in part on popularity levels of the media programs.

18. The method as recited in claim 14, wherein the prefixes and suffixes may be chosen according to the optimization model:

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$$\min_{\theta} C_{remote}(\theta) + P\beta C_{regional}(\theta)$$

5 wherein:

C_{remote} is a number of channels for remote server multicasts;

$C_{regional}$ is a number of channels for regional server multicasts;

P is a number of regional servers;

β is a cost of a regional server channel, relative to that of a remote server channel, and

θ represents whether one of all and a portion of an object are stored at least at one of the regional and remote servers.

19. The method as recited in claim 14, wherein the model is subject to the conditions of:

$$C_{regional}(\theta) \leq N_{channels};$$

$$D_{regional}(\theta) \leq N_{segments};$$

$$\theta_i^R + \theta_i^P + \theta_i^r = 1, i=1, 2, \dots, n; \text{ and}$$

$$\theta_i^R, \theta_i^P, \theta_i^r \in \{0, 1\}, i=1, 2, \dots, n,$$

wherein:

i is the media program;

$D_{regional}$ defines storage needed at each regional server;

θ_i^R has a value of 1 if the media program is stored only at the remote server, and has a value of 0 if the media program is not stored at the remote server;

θ_i^P has a value of 1 if the prefix is stored at the regional server, and has a value of 0 if the prefix is not stored at the regional server;

θ_i^r has a value of 1 if the entire media file is stored regionally, and has a value of 0 if the entire media file is not stored regionally;

$N_{channels}$ is a maximum number of channels at each regional storage location; and $N_{segments}$ is a storage capacity at each regional server.

20. The method as recited in claim 12, wherein the prefix and suffix are determined so as to reduce costs associated with transmitting the media file to the plurality of clients.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 6,868,452 B1
DATED : March 15, 2005
INVENTOR(S) : Derek L. Eager et al.

Page 1 of 2

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 6,

Line 2, "tying" should be -- lying --

Column 10,

Line 64, "leading: group", ":" (semi-colon) should be deleted

Column 11,

Line 9, "Further, more" should be -- Furthermore --

Column 13,

Line 47, in "given by," ", " (comma) should be deleted

Line 65, "1P is the arrival rate" should be -- /P is the arrival rate --

Column 14,

Equation 7, " $- X_i^{t,P} =$ " should be -- $X_i^{\frac{l}{i},P}$ --

Equation 8, " $- X_i^{t,R} =$ " should be -- $X_i^{\frac{l}{i},R}$ --

Equation 9, " $- {}_1 + \theta_i^R X_i^{t,R} kwT_1$ " should be -- ${}_1 + \theta_i^R X_i^{\frac{l}{i},R} kwT_1$ --

Column 15,

Equation 10, " $- + \theta_i^P X_i^{t,P} kwT_1$ " should be -- $+ \theta_i^P X_i^{\frac{l}{i},P} kwT_1$ --

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Page 2 of 2

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 18,

Line 20, " $C_{\text{regional}}(\theta) \cong N_{\text{channels;}}$ " should be -- $C_{\text{regional}}(\theta) \leq N_{\text{channels;}}$ --

Line 21, " $C_{\text{regional}}(\theta) \cong N_{\text{segments;}}$ " should be -- $C_{\text{regional}}(\theta) \leq N_{\text{segments;}}$ --

Signed and Sealed this

Thirty-first Day of May, 2005

A handwritten signature in black ink on a dotted background. The signature is written in a cursive style and appears to read "Jon W. Dudas".

JON W. DUDAS
Director of the United States Patent and Trademark Office